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SUGGESTIONS FROM AMERICA FOR CO-OPERATIVE SELLING.

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ALTHOUGH agriculture is one of Britain's greatest industries, there is room for considerable improvement in the methods followed in marketing certain classes of agricultural produce. Many farmers, while devoting great energy and ingenuity to production, have left the art of selling to a large extent undeveloped.

The greatest difficulties in the way of efficient marketing of home-grown farm produce have been lack of standardisation, rough methods of packing, and absence of association in the public mind between a name and a standard of quality. With regard to certain kinds of produce, especially dairy produce, which go through a factory, these faults have already been remedied by enterprising firms.

Where no system of standardisation exists dealers must examine each case of goods offered for sale; and after the purchase of a number of small quantities, each of a slightly different standard, it is difficult to make up a large quantity of uniform quality to offer to large purchasers. Farm butter bought in small quantities is often blended and re-made by wholesalers, or re-formed by the Scotch-hands in the retailer's shop. Reliability of the quality of products is one of the most important factors in the stability of any business.

The necessity for an improvement in the methods of packing should need no further advocacy when it is remembered that fruit often suffers in transit to the extent of twenty per cent. of its value.

From individual farms which are properly equipped and managed many products could be sent out with a guarantee of quality and bearing a distinctive label. If milk, cream, butter and eggs are supplied direct from a farm to suburban customers, the farmer himself, or a member of the family, must take charge of the selling and advertising department; but where the producers are not located near the consuming market little can be done without a Producers' Association. Such an association need not interfere with the production on individual farms, but should simply supervise the grading, packing, and advertising for a group of individuals. The internal economy of each constituent farm may remain unchanged, and yet the market status of the commodities produced in any neighbourhood may be raised considerably. For example, this would be comparatively easy in a neighbourhood where a particular kind of cheese is made.

Examples of Successful Associations.—(1) In America farmers have begun to realise the value of grading and branding products. For example, an agricultural association in Milwaukee County has recently decided to mark with the association's label all products put on the markets by its members. This means that the products have been tested and have come up to a certain standard. Individual farmers have been using brands for their produce in other localities besides the "middle-west." Urban firms which deal in the products of the farm long since adopted standards and labels for their goods. In all American cities there is a large trade in milk and bottled cream; and the local farmers supplying milk in town are obliged to follow the methods adopted by their energetic rivals. In English towns there should be an immense trade for this class of produce, especially when the produce is supplied direct from the farm with the suggestion of the country in both the goods and the label. The trade only requires to be initiated by a few enterprising farmers.

(2) *The Californian Fruit Growers' Exchange* furnishes another example of American enterprise in co-operative selling. This Exchange, which is one of the most effective farmers' co-operative societies in the world, does not produce fruit, nor does it buy from the farmer or sell to the shopkeeper. The growers form small community organisations. These bodies usually own small packing houses alongside a railway, where the members' fruit is collected, graded, pooled, packed and prepared for transport, these operations being done at a cost pro-rated on the number of boxes consigned by each grower.

Occasionally the association handles the fruit of each member separately. No profits are accumulated and no dividends are declared. The small community organisations are federated into Districts with a federal organisation known as a District Exchange. The function of the District Exchange is to act as a clearing house in co-operation with the associations through the facilities provided by the Fruit Growers' Exchange. Its duty is to order railway wagons and see that they are placed by the railway companies at various packing houses, to keep a record of the wagons despatched by each association, to place information before the local associations, to receive the returns for the fruit from the central Exchange, and to distribute the proceeds among the associations. The central Exchange is managed by a General Manager and one representative from each District. Its function is to furnish the marketing facilities for the District Exchanges at a *pro rata* cost.

Under the direction of the General Manager, agents are posted in many of the large distributing centres in the United States and some other countries. These send in daily reports on the state of the market, and order such supplies as they can sell. As soon as these orders are received they are distributed among the District Exchanges, and the fruit is despatched direct from the farmer to the local agent or to the purchaser. The agent acts directly under the order of the consignors, and the farmer is charged a commission on the sales made. Neither the District nor the Central Exchanges make any profit.

In this way the market is almost perfectly organised. Wherever there is a demand it is met as long as there is an available supply. The quality of the fruit is known by distributors because it is properly graded, packed and labelled by the local association, yet it remains the farmer's property till it reaches its ultimate destination. There is no leakage of profits between the farmer and the retailer.

A modification of this method of organisation might be applied by our English cheese-makers, and the prime products of Cheshire, Somersetshire, or Wensleydale could be much more widely distributed in England than they are at present. When English cheeses are selling quite cheaply in some districts it is almost impossible to buy them in others, because the necessary channels of distribution do not exist.

American conditions are different from those existing in England, but the difference is chiefly one of degree. Whenever produce has to be sold outside a small local area it must be

collected in large quantities for purposes of transportation. For sale in bulk standardisation is necessary. It makes no essential difference whether the distance between the place of production and the consumer's market is fifty or a thousand miles. Unless farmers take steps to organise and grade the supply of their products some kind of middleman will do so. Associations of farmers can do this much more cheaply and efficiently than middlemen, because the necessary grading and packing would be carried out at an earlier stage than is possible when the produce has to be sold from the farm before these processes can be attempted. Excluding the District and Central Exchanges, necessitated by a large volume of business, the system of the Californian Fruit Growers' local association for grading, packing, organising truck loads, and appointing agents, might be adopted by some English farmers—amongst others, fruit growers and cheese-makers. Such an association should be run on a non-profit basis, charges being made on the cost of processes and commissions for agents.

(3) Little development has taken place in the marketing of home-grown fruit in England during the last few years, although the sale of fruit has increased enormously; but in some districts improvements have been made, and the following example of a successful individual effort shows that there is scope for enterprising people who are willing to sell services as well as bare commodities.

In Lancashire a tenant of about 120 acres of farm garden land has about 30 acres under apples and rhubarb. Some years ago he had trouble in disposing of his apples at a satisfactory profit, and therefore changed his methods. Instead of packing apples of all sizes in "pots" of 64 lb. as before, he grades them according to size in boxes containing 24 lb. each. These are sold in the ordinary way on the Liverpool Produce Market. A load of apples is gathered straight from the trees, graded in boxes as they are picked, weighed and placed on the wagon. Next day the carter takes them into the market and stands there to sell one box or one hundred boxes to any customer who will pay the prevailing price of the day for the quality he offers. The bargain is made between the carter and the customer, and these apples generally make a price above the average. The reason why 24 lb. was adopted as the standard size for the boxes was twofold. As each farthing per pound is equal to sixpence per box it is not difficult for the carter to compute the price of any number of boxes; and 24 lb. is not too small for the retail dealer to handle nor too large for the private consumer. When apples which are not fit for immediate

use are sold—as they often are—the name of the variety and the month of ripening appear upon the ticket. All varieties except such common ones as “Blenheims” are named.

The boxes are made by the farm labourers during wet weather, generally during the winter, so long as storage room is available. The wood is bought in Norway, cut to a standard size, and comes bound in wire, a dozen ends, a dozen bottoms and so on. An ordinary bench, a simple arrangement of a plank with two slits to hold the ends while the first side is being nailed, a hammer and nails complete the outfit. Round the top of the box is nailed a strip of wood 1 inch by $\frac{1}{4}$ inch to form a rim, so that when the boxes are loaded on the wagon there is no possibility of their falling off, and no need of roping, because each box fits into the one below it, and the apples are not bruised. There is no worry about the return of hampers, and the boxes are always clean and are cheaper. A little capital is necessary to buy the wood in sufficient quantity to order the cuts to make a standard box without further trouble, but the expense is gradually recovered. Even with hampers which may normally be expected to last several years there is continual loss. Though a few hampers from amongst a certain purchase may remain in stock for several years, experience proves that practically a new supply is needed as each fruit season comes round.

If this method of marketing fruit were adopted, the boxes might also be used for retailing potatoes, especially selected tubers for roasting. Otherwise potatoes might be marketed in small sacks of about 28 lb. or 56 lb. in which form they are easy to handle and are suitable either for the retailer's shop or the consumer's cellar.

Suggestions for Packing, Marking, &c.—In America, strawberries are packed by the quart in shallow “chip” boxes with a rimmed bottom which are then placed in a light case, sixteen boxes to the case.

When butter is produced in fairly large quantities, that too should be packed in light wooden cases. Any up-to-date saw mill would supply the white deal boards cut to standard sizes, and the boxes can be nailed together quite easily. To be sent to the market or shops, butter should be packed in boxes of two or four dozen pounds. Each pound of butter should be packed as a brick in stiff, grease-proof paper. If a farm or association brand is used, each end should be sealed with the gummed stamp. When sold retail the butter should always be packed in cartons. These can be bought quite cheaply and in them the butter can

be carried in the milk float in an open box or basket in the handiest possible form, being kept perfectly clean and cool and in good shape. The makers will print a farm or association brand on the cartons as may be desired.

Standardisation and the guarantee of quality are more important than the label. In the case of a society of producers carrying out the later processes together in one building, it is quite easy to grade, standardise and label the goods. Even where all the processes are carried out on individual farms it should not be difficult. If a group of cheese-makers formed an association, collected a subscription according to acreage or to the number of cows kept, and drew up rules stating the minimum standard of cleanliness and equipment of cows, sheds, and cheese-room, it could then employ a competent judge of cheese to inspect and label the products of each farm.

This system of inspection and marking could be pursued also in the case of butter, providing rules were enacted that the cows, sheds, and dairy equipment were of a given standard, and that the marker had power to inspect these and make reports. The right to refuse to brand an article must always be given to the society's inspector, with a provision for immediate appeal to one or two other persons who should be nominated for the purpose.

It is a very debatable question whether eggs should be marked at all, unless they are supplied direct from farm to consumer. If they are branded with the name of a farm, and a dealer happens to supply a customer with eggs he has kept too long, the customer avoids the branded egg for the future. For obvious reasons dealers object to eggs which are branded with the date when laid. In selling direct to customers, however, these considerations need not be entertained. When sending butter and eggs to a produce market it is well to have the boxes or crates distinctly marked with the brand of the farm. If the dealers are sure of the origin of the goods the price is likely to be a good deal better than if they are not.

The Use of Brands.—The brand should be just the visualised expression of the quality of the goods it covers. In the case of a group of cheese-makers something distinctive of the locality might well form the design for the brand.

For Cheddar cheese the Cheddar rock might be depicted in strong clear outlines, and a short name for the society with a motto of two or three words might be added. It is essential that the name of the society be short, and not clumsy or ugly. The

motto also should be pointed and should refer directly to the article it is to distinguish. A design which might be used by a group of meat or other producers is shown in Fig. 1.

The items of chief importance about the design for a label are that it should be small, and "strong" or distinctive. It should never be complicated or over-loaded. In choosing a design the judgment of the women of the farm should be relied upon; as women are the chief purchasers of farm produce their likes and dislikes must be studied if they are to be attracted. In many cases the wife or daughter of a farmer is quite capable of designing a brand for farm products.



FIG. 1.—Design for a label for a group of meat producers.

The design may be used in two forms: as a die for printing, and as a rubber stamp. For butter, small cheeses, honey and preserves it should take the form of a printed stamp with a gummed back. For milk or cream bottled by machine the brand should be printed on the cardboard stoppers before they are sent out from the factory. Where a brand is used for a number of commodities the colour of the ink should be varied, *e.g.*, black for milk and red for cream.

Types of brands are shown in Figs. 3 and 4.

So far none of the fancy methods of marketing, such as the parcel post, or the "family hamper" have been mentioned. Nothing has been suggested save improvements in the ordinary methods of marketing fruit and dairy products, in which direction there is more to be done and more profit to be obtained than in developing costly and uneconomical methods of direct supply. The main suggestions are for the grading, standardising and advertisement of products.

Advertising.—Municipalities have long recognised the value

of advertising, and if rural communities have capital to spare they might well follow this example.

"Ensure and advertise quality" should be the farm salesman's motto, and wherever possible a group of producers or a community should advertise. They should attempt to secure a national reputation for the production of an article for the neighbourhood. This can be done in regard to more than the small products of the farm. Waukesha county in the State of Wisconsin is known as "the Guernsey Island of America,"

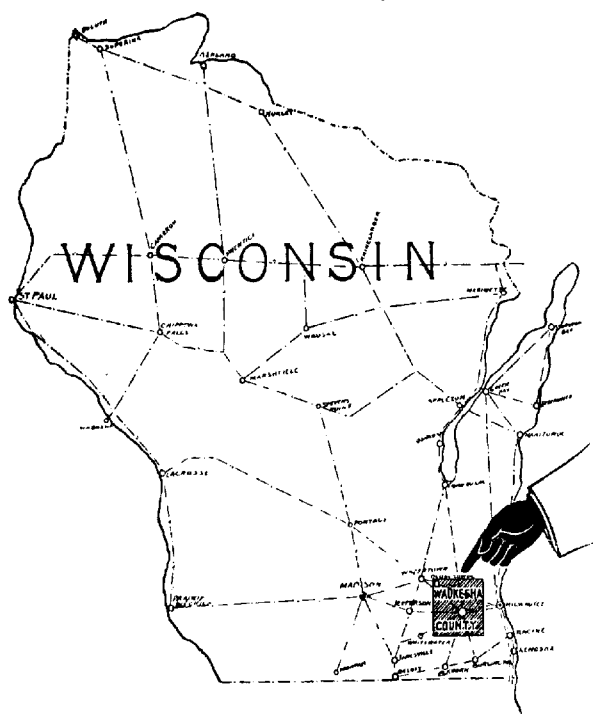


FIG. 2.—American method for securing a national reputation for the produce of a small locality.

and is said to contain more pedigree cattle of this breed than the island of Guernsey itself. Some years ago, before the demand for improved dairy cattle became prevalent in the United States, a Guernsey Breeders' Association was formed in the county, and consignments of stock were bought in Guernsey. Since then the Association has bred, selected, tested and advertised, till the neighbourhood has gained a

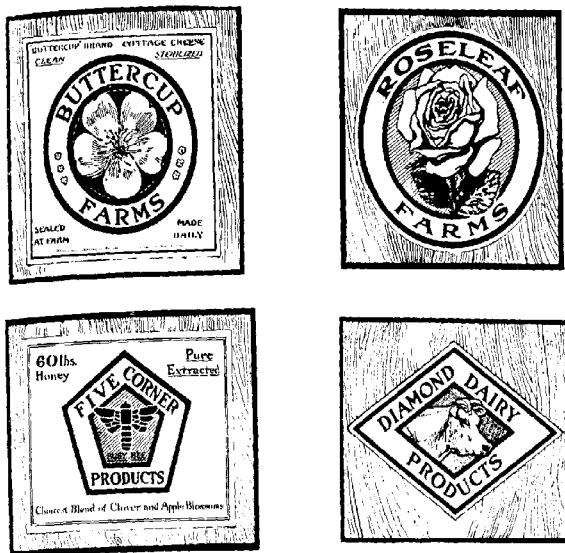


FIG. 3.—Specimens of American Brands.



FIG. 4.—Suggestions for English Brands.

continental reputation. Each year the Association publishes special and general advertisements. Members participating in special advertisements are specially levied, otherwise each member is levied for the general advertisements according to the number of animals he sells. In the general advertisements a sales list is published, but the president is supplied at intervals with a list of the animals offered for sale by members, and when enquiries are made, as they continually are, prospective purchasers are directed to the people who can supply their needs. By advertising in national papers, purchasers are brought from all over a continent to a little county in a state which itself is about the size of England. If the farmers of some locality in England would pursue a similar policy with regard to dairy shorthorns at the present moment it would undoubtedly result in great prosperity for the neighbourhood, and prove of benefit to farmers generally.

General Advertising.—Advertising by means other than the brand or name on the article sold has not been touched upon, but leaflet, postcard, display poster, and newspaper advertising might be considered by farmers and farmers' associations. In the case of a cheese or butter producers' association, advertisements might be placed in the trade journals of the grocery and allied trades. When individual farmers are entering a new district, or placing upon the market a fresh product, these means of advertising could be utilised to assist in the establishment of custom. It would often be cheaper to incur some preliminary expense in advertisement than wait for custom to develop slowly. By getting the working equipment into full use at the earliest possible moment more capital can be saved than is laid out in advertisement. For the purpose of advertising the products of an individual farm the "classified" pages of a local newspaper may be used, or a "display" advertisement may be inserted. Postcards of the farm or the product, or handbills may be delivered. These should state that the delivery cart will call on a certain day, preferably the day following distribution. The perfection of the arrangement should be assured; the wording should be terse and interesting and well set out. There is nothing more wasteful than printing which is not specific.

Another method of advertising which is becoming quite popular in America with urban producers and distributors is that of the display slide on the screen of the local kinema or picture theatre. This method could be used effectively by an individual farmer or a group of farmers. The farmer prospecting for custom could easily arrange for a photographic display

of his homestead—if picturesque—or a group of his cattle. A group of producers could arrange for a film giving pictures of distinctive features of the scenery of the locality, of processes of production, and of the finished product, closing with a good representation of the society's brand. Such films could be distributed over a wide range of towns. If a film were good enough to become a "feature" the mere loan of it would be sufficient to ensure its display in some picture theatres.

The British farmer can produce commodities of the very best quality and there is no reason why he should not offer them to the public in the best possible form, or take steps to ensure that the public shall realise the quality of the goods he offers.

THE CULTIVATION OF SUGAR BEET IN THE WEST OF ENGLAND.

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IN continuation of the enquiry into the prospects of introducing and establishing the cultivation of sugar beet as a part of our farming system,* the writers have now conducted investigations in the counties of Gloucester, Somerset, Devon and Cornwall. These investigations revealed a situation in the last county so different from that in the others that it seems advisable to deal with it separately. On many of the best working soils from Tewkesbury in Gloucestershire to Taunton in Somerset and Bideford in North Devon, experiments in the cultivation of sugar beet were carried on during the year 1912. In this area 95 farmers grew beet on 140 acres, most of them on plots of one acre. A few of them have continued to grow very small quantities. So far as experiments conducted on this scale can be regarded as indicative of what might be achieved if larger areas were cultivated under average conditions, these served to demonstrate that heavy crops with a high percentage of sugar could be grown.

Throughout the whole of the area farmers who had tried the crop expressed themselves as fully satisfied with the yield, the majority of them saying that they grew about 15 tons of washed beet to the acre. In two or three districts—in the neighbourhoods of Stroud and of Bideford particularly—it had been grown quite successfully on some upland farms

* See this *Journal* for February, 1915, p. 969.

where the soil was deep enough, but owing to the steepness of the hills and the distance from stations, it was obvious that any development of the industry was impracticable in these districts. Elsewhere, so far as physical conditions are concerned, there is little doubt that satisfactory crops could be grown, and that the carriage of the roots to a factory would present no insuperable difficulty. Root-growing, although not widely extended, seems to be as highly developed here as in any part of the country. Speaking in a general way, and not basing their statements on actual weighings, farmers repeatedly said they got from 50 to 80 tons of mangolds per acre. Seldom or never does drought cause any difficulty in getting a crop, and therefore root crops with them are more certain and regular than they are in counties further east.

Other and more influential considerations, however, are at work, rendering the prospect of introducing the industry in these counties remote. The attitude of the farmers differs widely from that of those who were visited in Norfolk and Suffolk. Out of 20 men between Tewkesbury and Bideford who had cultivated beet successfully only three showed any positive inclination to co-operate in supplying a factory with the roots. Established customs and economic considerations more than cancel the favourable physical conditions. The arable land in Gloucester, Somerset and Devon is a small proportion of the total area, and the pressure on the narrow stretch under roots has perhaps seldom been greater. Farmers have increased the area under corn to the widest possible limits, curtailing, temporarily at least, the usual extent of the root crop. Feeding-stuffs are abnormally dear. Mangolds were said to be selling at from 15s. to 20s. per ton in Bristol, thus yielding large profits to farmers who had any to spare after providing for their own live stock. These facts are sufficient to account for their present attitude of indifference. It is true that several of the farmers were sympathetic with the idea of getting a connection with the sugar market, and of adding another branch to their industry. They had appreciated for themselves the possibility that some day the production of corn, beef and mutton may be less profitable, and that it would be well to have an additional substitute on which to rely, but even those men who, by their interest in the matter, gave the impression that they were more circumspect than the majority, offered no encouragement for the promotion of any scheme for using the present opportunity to establish a sugar beet industry.

The chief points which explain the situation in these counties may be summarised as follows :—(1) The growing of sugar beet never assumed an economic shape. The roots were not sold to make sugar, as they are in the Eastern Counties, but were fed to live stock, and farmers were recompensed by grants from outside. (2) Farmers were impressed in connection with their experiments by the difficulty and cost of lifting, the shortage of labour having been experienced for a considerable time, while the lifting machine had generally come too late or had worked unsuccessfully. (3) Corn, beef and mutton offer high and certain profits at the moment, and all call for less labour than sugar beet. A farmer near Bridgwater who had sold lambs at 53s. 6d. during the last week of March said he thought sugar beet might be a good thing in a depression, but just now he would not dream of reducing the area under swedes, mangolds and green food for his sheep. (4) The introduction of sugar beet, therefore, would seem to involve the breaking up of grass land, and this farmers will not contemplate with the present scarcity of labour. The conclusion, therefore, with regard to Gloucester, Somerset and Devon, is that the attitude of the farmers at the moment does not offer the slightest encouragement for providing a factory to put them into touch with the sugar market.

Enquiries which have been made by letter in Berkshire, Wiltshire, and North and South Wales seem to indicate a similar state of affairs in these districts. Sugar beet can be grown successfully, but there is no disposition on the part of the farmers to take up the enterprise at the present time.

The situation in Cornwall differs from that in the other western counties as well as from that in Norfolk and Suffolk. At first it seems natural to expect that the conditions which obtain in Somerset and Devon would be found in Cornwall, that with the prevailing high prices for most forms of produce farmers would be firmly attached to their present system. This is the case so far as north and east Cornwall are concerned, but in the south and west certain changes occur which give rise to an entirely different position. In these districts the style of farming does not permit the production on any considerable scale of the things which are now most profitable. As is the case in Cheshire and a few other counties, small holdings form a very large proportion of the total number of holdings in Cornwall. These holdings are nearly all arable, or mixed dairy and arable. They are largely devoted to growing market garden crops—early potatoes and broccoli

being the most common. For neither of these commodities have the markets improved as they have for corn, beef, mutton and even dairy products ; in fact, it is stated that competition from abroad is becoming keener. Sugar beet therefore offers, relatively, something more to the men on the small holdings than it does to the larger farmers. Milk production has benefited little by the rise in prices, and it has lost something on the other side owing to the increased cost of feeding-stuffs. The men, therefore, who are, in a sense, committed to this style of farming are securing practically no share in the improved returns, and consequently they are not so indifferent to the opportunity of getting access to a market which is certainly bigger than any that they now command.

Another consideration which causes the small holders who grow potatoes and broccoli year after year on the same soil to regard the introduction of sugar beet with some favour, is the fact that club-root has affected the broccoli rather seriously for some time. The growers would therefore welcome an alternative crop which would give them a cash return, and enable them to rid the land of the club-root infection. They think that sugar beet would serve this purpose.

Again, the labour difficulty, which was the first and last objection urged by most of the large farmers, is a less serious obstacle here, if it amounts to one at all. It was said that the crops now grown on small holdings required as much labour as sugar beet. In most cases the farmers and their families perform the greater part of this work, and do not depend on hired labour even at special seasons. They are also familiar with crops requiring a good deal of attention in small details, and the difficulties of lifting crops and transporting them to the nearest station, which loomed large in the eyes of some of the bigger farmers, are part of their normal working conditions.

In addition to these features by which the situation in Cornwall is distinguished from that in other western counties, and largely because of them, a further step has been taken towards the establishment of the sugar beet industry. The Cornish farmers have the habit of acting together for the advancement of movements which seem likely to benefit agriculture. This readiness to associate has shown itself in the very active county branch of the National Farmers' Union. Chiefly owing to the interest and activity of Mr. W. J. Hosken, of Hayle, members of the Union and other farmers have gone a considerable way towards guaranteeing a supply of sugar beet

for a factory, if one were erected. Simultaneously with the measures taken to assure the supply of sugar beet, a number of landowners, farmers and others interested in the matter declared their willingness to subscribe a substantial amount of money towards the erection of a factory, and Mr. Hosken stated that from these private sources one-half of the capital required for this purpose could be raised. A factory site was selected, and an option on it secured. The site seemed peculiarly suitable, having admirable facilities for transport by road, railway and water. Efforts were made a few years ago to start the industry, but the scheme did not materialise, for although farmers had signed contracts to grow sugar beet, the balance of the capital needed to establish the factory was not to be obtained.

With regard to the contracts a mistake seems to have been made in binding farmers to supply the roots for five years at a fixed price, taking no regard of possible fluctuations in the cost of production, or in the market for sugar, a price which would have been unreasonably low under present conditions. The farmers soon came to realise the disadvantageous position in which they had been placed, and representatives of the Farmers' Union said they were greatly relieved when the contracts became void owing to the non-erection of the factory. This experience has created a slight prejudice against the industry. The cost of growing has increased, and under the contract farmers would have been obliged to fulfil their agreements, receiving only such additional price as the factory management might have thought it expedient to concede. It seems difficult to avoid mistakes of this kind in arranging the relations of growers to the factory, for it has been noted that prejudice was created in the eastern counties in a similar way. Contracts for long periods at fixed prices are hardly reasonable in relation to a commodity so subject to fluctuations as beet sugar, since they nearly always result in one party being compelled to bear an undue share of the burden, and in an enterprise of this kind it should be quite sufficient if agreements were made for one year ahead. If the industry is likely to undergo varying fortunes, these ought to affect all parties in some definite proportion, and no agreement should be made which throws the whole burden on one, or cuts one wholly off from a share in the prosperity.

This enquiry was not exhaustive enough to justify any recommendations for immediate steps towards the erection of a factory. Before this could be done with sufficient confidence,

a more thorough investigation of the extent of the support likely to be given by the growers would be required on the part of those contemplating this step. The Secretary of the County Farmers' Union, speaking in his official capacity, said that if a definite price were offered to the farmers for the sugar beet at the farm-gate, or at the roadside, thus freeing them from uncertainty about the cost of transport and their net returns, they would be willing to grow an adequate supply. He mentioned what seemed to be a very moderate price. Too much additional, novel and uncertain work is imposed on farmers in the matter of growing and transport, and if the transport were organised in some way, it would remove one of the most serious difficulties in Cornwall.

From what has been stated it will be seen in what respect the position here differs from that in Norfolk and Suffolk. Seeing that 2,300 acres of sugar beet were grown in these two counties last year, and that individual farmers have cultivated from 5 to 100 acres, and have received considerable sums for the crops grown, there is a more substantial basis in fact in these counties for any capitalist who might think of investing money in the industry. In several respects, however, the Cornish situation is more promising. The great cohesion among the farmers is a guarantee that if the industry were taken up they would work definitely with the object of making it successful. There is less difficulty with labour, and owing to the climate the yield of the crop would probably be more certain.

This enquiry, therefore, seems to point to the conclusion that neither in Gloucester, Somerset nor Devon would it be wise or practicable to consider the erection of a factory at the present time. There is perhaps some reason for regret that this should be the case, and therefore more reason for considering sympathetically the proposal to do something in Cornwall. Although the great majority of farmers in the first three counties could not see their way to co-operate in developing the industry under existing conditions, several of the more thoughtful expressed the wish that all the preliminary and pioneer work could be done by some means, and that it might be so established that they could adopt it as easily as they have taken up dairying or potato-growing in the past. Like farmers in Suffolk, they suspect that the present high prices are not a sign of stability and soundness in agriculture, and that they will be followed by a depression in which farmers may be glad to try every market. They are not

short-sighted, but they feel that it is not their function to develop an industry for the general benefit of agriculture and for posterity, when it means that, to the extent to which they attempt this, they will be losing present opportunities of making money. Views and schemes covering developments over such long periods are appropriately entertained and carried through by wealthy associations, or by governments, rather than by farmers who hardly possess enough capital to run their business efficiently on familiar lines.

For reasons already given the situation is much more ripe in Cornwall. Capitalists who take the long view might with advantage co-operate with those farmers whose interests make it most worth while to introduce this industry, for there is little doubt that some day British agriculture will obtain a footing in the sugar market. In the fluctuations that are so likely to follow this unprecedented dislocation of the old sources and lines both of supply and demand, the stability of agriculture will be increased by every market to which the farmers can have access.

SOILS AND AGRICULTURE OF NORTH WALES.

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DURING the course of the past five years the writer has been engaged on soil investigation work in Shropshire and North Wales. In these districts soils differ markedly from those in the south-east and east of England, where most of the English work on soil problems has been carried out. The differences are most pronounced in North Wales, and it is the purpose of this article to describe the main features of the soils of that district, and to indicate their peculiarities.

The soils of the south-east and east of England are mainly derived from Mesozoic and Tertiary formations. In North Wales, the soils are, with the exception of glacial deposits, almost entirely of Palaeozoic and Pre-Cambrian origin. There is also a marked difference in the climates of the two areas. The English area has hot summers and comparatively cold winters. North Wales has cool summers and, except in the mountains, mild winters. Temperature records show that over south-eastern England the mean July temperature is from

62° F. to 64° F., while the mean January temperature is from 38° F. to 39° F. In North Wales the mean July temperature is from 59° F. to 60° F., while the mean January temperature is from 39° F. to 42° F.

In the matter of rainfall the contrast is more pronounced. The mean annual rainfall in the south-east of England is generally less than 25 inches and rarely rises above 30 inches. In North Wales, the mean annual rainfall varies from 25 inches at Rhyl to 160 inches at Llyn Llydaw on the side of Snowdon.

There are, in the counties of Anglesey, Carnarvon, Denbigh and Flint, approximately :—

100,000 acres with a mean annual rainfall of 25 to 30 in.	
130,000 " " " " " 30 " 35 "	
200,000 " " " " " 35 " 40 "	
300,000 " " " " " 40 " 50 "	
300,000 " " " " " 50 " 100 "	
70,000 " " " " " 100 " 160 "	

Most of the agricultural land is under rainfalls varying from 25 to 50 inches per annum. If detailed statistics were available, it would probably be found that the ratio of grass to arable land increases fairly regularly with increasing rainfall. It is not possible to get satisfactory evidence on this point from the official crop returns, since in the wetter and more elevated districts, rough grazing largely supplements permanent grass. Also, owing to the practice of leaving seed leys down for three, four, or even more years, at least half of the arable land in North Wales is usually in grass.

Coming to the actual characters of the soils of North Wales it may be mentioned at once that they almost invariably contain a high proportion of organic matter. This is the natural consequence of the climate, as may be readily understood from the following considerations :—

(1) The high rainfall and the mildness of the winters favour vegetable growth and render the land more suitable for grass than for arable farming. The distinction between grass and arable land is not so marked as in England, and the farmer knows that even if he ploughs up a piece of old turf he will have no difficulty in laying the land down to grass once more. Arable land is thus, for at least half the rotation, under grass.

(2) The decomposition of organic matter in the soil is retarded by various factors, all connected with the climate. In the first place the coolness of the summers probably tends to prevent the decomposition of organic matter. Further, aeration is not so thorough in grass as in arable land, nor can

it be so active in promoting decomposition when a large part of the air space of grass land is occupied by water as is undoubtedly the case during many months of the year.

(3) The drainage from soils in a wet climate such as North Wales must be much more copious than in a drier and warmer climate. At Rothamsted about half of the rainfall finds its way into the drainage. In North Wales the rainfall is higher, the temperature generally lower, and the atmosphere more humid than at Rothamsted. Evaporation and transpiration will consequently be hindered. The extra rainfall must escape as surface water or else as drainage, both of which are in consequence greater, relatively and absolutely, than in the south-east of England. It has been shown at Rothamsted that considerable quantities of dissolved matter are borne away in the drainage, notably carbonate of lime and nitrates. The loss of these valuable soil constituents is probably very high in the soils of North Wales. The heavy losses of carbonate of lime result in a marked tendency to "sourness" in soils. Of the soils examined up to the present the great majority contain no carbonate of lime. Even some soils derived from limestone have had all their carbonate of lime washed away.

There are thus several circumstances favouring the accumulation of organic matter, and these can all be attributed to the humid climate. Where land lies in an uncultivated condition in North Wales these tendencies have free play, and almost invariably result in the formation of a peaty layer at the surface of the soil.

Another characteristic of the soils of North Wales is the comparative uniformity of their mechanical composition. In the areas of soil surveyed in England well-defined types of soil appear. In North Wales, with the exception of peaty, sandy and alluvial soils, all the soils might be variants of one type. This is not due to the monotony of the geological structure of North Wales. The soils which so closely resemble one another in mechanical composition vary in geological age from Pre-Cambrian to Carboniferous and also include Glacial Drift soils.

In the field the uniformity is not so striking, the differences lying in the colour, amount of carbonate of lime, and water supply.

Generally speaking, the soils are medium loams containing sand and silt in fairly equal proportions. Clay is almost invariably the smallest fraction. Rarely does it exceed 10 per cent. of the soil, and this is surprising, since much of the soil of North Wales is derived from shales and mudstones.

The uniformity in mechanical composition is sufficiently striking to suggest that, in this area, climatic factors are predominant in determining the manner in which rocks shall disintegrate.

Chemically, the soils of North Wales show two peculiarities. Firstly, as shown above, they are almost always deficient in carbonate of lime; and, secondly, they contain higher proportions of potash soluble in hydrochloric acid than might be expected from their mechanical composition, even sandy soils showing no marked poverty in potash. The relative richness in potash is probably due to the presence of potash minerals in the fractions of the soil usually classed as sand and gravel.

Experimental work on humid soils is as yet only beginning, but it seems likely that there is a fundamental difference between soil formation and plant nutrition in wet and dry climates. While the districts of England in which soils have been studied hitherto are not, strictly speaking, dry, yet the difference in climate between those districts and North Wales is sufficiently pronounced to make it doubtful whether the principles of plant nutrition and soil treatment, as understood at present, can be applied unconditionally in the latter area.

In the case of unmanured soils, a state of equilibrium is reached in which the loss of plant food by crops and by drainage balances the plant food rendered available by chemical and bacterial agencies. This equilibrium cannot be the same where the losses and gains of plant food are quite different. More plant food is likely to be lost to the soil through drainage under humid than under dry conditions. Manures are added to the soil to supplement the natural supplies of plant food. On the results of the Rothamsted experiments, certain principles of manuring have been formulated which doubtless hold good where the natural losses and gains of plant food are similar to those at that place. Where the losses and gains are totally different the Rothamsted work cannot strictly be used as a guide to soil treatment, and the need for new experiments under the particular climatic conditions in question is indicated.

Waste Lands.—There are in North Wales considerable areas of waste land. Much of it in Denbighshire and Carnarvonshire is moorland or mountain land lying at altitudes which render reclamation work out of the question. There are, however, areas at lower altitudes which might possibly prove suitable for reclamation. They fall into the following classes :—

(1) Sandy stretches, which occur along the southern coasts of Carnarvonshire and Anglesey, and also along the northern

coasts, around Conway, Rhyl and Prestatyn. 'Some of this land is already in use for market gardening and possibly the area might be extended. As an instance of the effect of the humid climate, a soil in Anglesey which grew passable crops of potatoes and carrots was found to contain nearly 95 per cent. of coarse sand.

There are also sandy stretches which were formerly arms of the sea. One of these, Malltraeth marsh in Anglesey, has an area of over 3,000 acres. It is provided with a sea wall and embanked river for drainage, but further work is necessary before really satisfactory cultivation can be practised. Were this additional work carried out, the area would probably prove very suitable for market gardening.

(2) Peat is found generally over the whole of North Wales. In Anglesey, there are several peat areas lying at low elevations which might be drained. In west Carnarvonshire a considerable area of thin peat occurs lying over a sandy subsoil. If this area were reclaimed the sand might be used to ameliorate the peat.

(3) Over a large part of Carnarvonshire west of Snowdonia there are great tracts of Glacial Drift soil which are at present almost entirely waste. Much of this land is covered with short tufts of gorse and heather, together with wiry grasses of little value. The soil is generally a thin loam over a stony clay subsoil. In many places there are patches of peat. The main task in reclaiming such soils is the clearing of stones and boulders. This has been done to a large extent in the Nantlle and other quarrying districts, where occasional labour is available. The small grass holdings thus formed appear to be fairly productive and carry grass of very good quality. Some of these grass holdings are as much as 1,000 feet above sea level.

(4) Over a large part of Denbighshire are vast heather moors. The soil is generally peat, lying over a subsoil clay derived from Silurian or Ordovician shales and flagstones. Here and there, doubtless, reclamation might be carried out, but the wetness and inaccessibility of these areas is a serious bar to their use for anything but rough grazing and sporting purposes.

Agriculture in North Wales.—The agriculture of this area and its connection with climatic and soil factors may now be outlined. Grass is the predominant feature in the farming of North Wales. This, of course, means live stock farming, and the living of the North Wales farmer is, in fact, made chiefly by the rearing of store sheep and cattle. On some farms grass

fattening is practised, but in general the soil is not sufficiently fertile or the aspect is too bleak for this type of stock farming.

The proportion of arable land is not large, and is generally less than 30 per cent. of the total under crops and grass. The usual rotation is as follows: Oats are followed by roots and a second crop of oats follows the roots. Sometimes barley is taken instead of the second oat crop. Grass seeds are sown in the second oat crop or in the barley, and the land is kept for hay for one or two years. After that it will be grazed for two, three or more years and then ploughed up again for oats. Thus, it happens that half or more of the land returned as arable is always under grass.

The crops which flourish best in North Wales are oats and swedes. With good farming, eight quarters or more of oats per acre and twenty to thirty tons per acre of swedes are frequently grown.

Barley is grown to a certain extent in west Carnarvonshire and in parts of Denbighshire and Flintshire, but is more commonly used for feeding than for malting purposes.

Wheat is found in the vale of Clwyd and in east Flintshire. In these areas the rainfall is between 25 and 30 inches per annum. Where the rainfall is greater than this, wheat is hardly grown at all.

Dairying is practised in east Flint and Denbigh, and to a small extent throughout North Wales. The principal business in cattle, however, is the raising of stores, and Anglesey is the chief county for this pursuit. Its principal market, Llangefni, is largely attended by buyers from all parts of the country. Anglesey cattle are found on the pastures of the Midlands and in the fattening yards of Norfolk.

All the counties of North Wales have large numbers of sheep, but in this respect the chief counties are Carnarvonshire and Denbighshire.

Market gardening is found on a small scale in various parts along the sea coast. The mild winters in these districts should allow of much more extended cultivation of vegetables. Experiments with early potatoes instituted last year by the Bangor Agricultural Department have yielded encouraging results. Climate and soil are such that Anglesey and west Carnarvonshire might be expected to compete with Cornwall in the early potato market.

Bulb growing has been initiated in many parts of North Wales, with promising results, the yield being generally good and the bulbs of high quality. Soils from various bulb farms

have been examined by the writer. In the vale of Clwyd a bulb farm which won thirty prizes last year has been established on a rather heavy loam containing a good proportion of carbonate of lime, and lying over a stiff clay subsoil. Three soils from successful bulb gardens in Anglesey agree in being rather light in texture and containing little or no carbonate of lime. The annual rainfall in the vale of Clwyd is about 27 inches. In the districts of Anglesey where the above-mentioned bulb gardens are found, the annual rainfall is about 36 inches. It appears therefore that bulbs are not very particular as to the soil which they require.

THE PREVENTION OF EGG-LAYING ON TURNIPS BY THE DIAMOND-BACK MOTH.

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It is well known to farmers in Great Britain that the caterpillars of the Diamond-back Moth have, in certain years, caused enormous damage to the turnip crop. Curtis quotes the letter of a correspondent who, in describing the ravages of the little green caterpillars on a field of turnips, states that "so incredible were their numbers, that on a single plant of moderate size, and taken at random, I counted upwards of 240. and before the end of the first week in August every leaf, for the space of more than an acre, was completely reduced to a parched-up skeleton: not a turnip escaped them, and by the middle of the month you might have looked in vain for the smallest vestige of a green leaf on the field of their depredations."*

In 1891 an outbreak of such seriousness occurred that the Board of Agriculture issued a "*Special Report on the Attack of the Diamond-back Moth Caterpillar.*" In that year the Eastern Counties, from Kent to Aberdeenshire, are recorded as having been principally affected, and the intensity of the damage done can be judged from the fact that "whole fields of turnips, swedes, rape, and cabbage were completely ruined by the hordes of caterpillars infesting their leaves."†

* *Farm Insects*, John Curtis, p. 87.

† Leaflet No. 22 (*The Diamond-back Moth*).

Miss Ormerod, in her Report on the Diamond-back Moth outbreak of 1891, brought forward some "considerations pointing to the probability of the infestations having been blown across the ocean from the Continent." (*Jour. Roy. Agric. Soc., England*, 1891, p. 612).

It would seem, however, that the occurrence of the moth in exceptionally large numbers only in occasional years can be more easily accounted for by a study of the weather and food conditions. The moth, indeed, must be regarded as being always with us. It may happen for several successive years that, owing to heavy rains, wind, parasites, etc., killing off a large percentage of the last brood of caterpillars for the year, only a small number of cocoons will remain throughout the winter to produce the spring brood of moths for the following year. If, however, conditions are such that this brood develops well and lays its eggs, and if drought and sunshine prevail until July or August, the successive broods may multiply in extremely rapid geometrical progression. Further, if the last brood of caterpillars were able, owing to good weather conditions, absence of parasites, etc., to survive the winter in the form of pupæ, the result would be a remarkable appearance of the moth in the ensuing spring.

As it is, in most seasons, rain and other conditions unfavourable to the moth seem to check its increase, while at the same time, the advent of rain helps on the crop.

The specially dry season of 1891 allowed the moth to increase enormously in the north-east of England, and the east of Scotland, until, towards the end of July and during the first part of August, low temperature was accompanied by heavy and continuous rain, which was either fatal to the caterpillars, or "washed them from the plants and checked their progress." (Leaflet No. 22).

Since that year there have been, particularly in the Northern and Eastern Counties, outbreaks of a more or less serious nature, and only last summer (1914) a large number of farmers suffered much loss owing to the ravages of the caterpillars on their turnips. A peculiarity of the attack was that, though the moths and caterpillars were particularly prevalent in some turnip fields, other turnip fields in the same district were comparatively free from the pest.

Indeed, it would appear, from an examination of the reports sent in, that the appearance of the pest was of a specially 'sporadic' nature, for it is stated in one case that "in one field of turnips there were none, while a field adjoining was bad," and in another case "one field was bared in one day, the damage

stopping at the top of a hill in the field." The significance of these examples of very local infestation seems to be that the moth does not travel far, and that, therefore, efforts to rid a field of the moths or caterpillars, *at the beginning*, would have the effect of saving the crop.

About the beginning of the summer of 1914 reports of a small moth appearing in large numbers amongst turnips began to be sent in to the Agricultural Department of Armstrong College. The specimens received were, in most cases, identified as those of the Diamond-back Moth (*Plutella maculipennis*, Curtis), and it is interesting to note that the moths of this generation were of a very light colour, only a small percentage of them showing clearly the characteristic diamond-shaped markings on the wings when at rest. On June 17th specimens of the moth were brought in by a farmer in Belford (Northumberland) who stated that they were appearing not only "in clouds" amongst his turnips but also in large numbers amongst his potatoes, to which crop the early brood, issuing from cocoons in the headlands, etc., may have gone to lay eggs on cruciferous weeds therein.

No actual damage to crops was as yet observed, but, seeing that much injury was likely to be caused by the larvæ issuing from the eggs of these moths, the Agricultural Department of Armstrong College decided that this would be a fitting time to begin trials at Cockle Park with a view to preventing the female moths from laying eggs on the turnip plants.

A field of turnips was chosen where the moths were to be seen flying about in large numbers, especially in the early mornings. Square plots, each one-twentieth of an acre in area, were marked out, and received dressings as follows:—

Plot I.—Paraffin and Fine Sand: Mixed in the proportion of $1\frac{1}{2}$ pints of paraffin to 1 bushel of sand and spread by hand along the drills, over and round the turnips, at the rate of 6 cwt. per acre.

Plot II.—Lime-sulphur: One pound of shell lime (slaked before boiling) and 1 lb. of sulphur were boiled in 1 gallon of water for half an hour. This was then made up to 10 gallons with water and applied at the rate of 40 gallons per acre by means of a knapsack sprayer.

Plot III.—Paraffin and Sand: Made up as for Plot I., but put on at the rate of 3 cwt. per acre, and broadcasted.

Plot IV.—Ground Lime: This was used fresh, 1 stone being applied on the plot (*i.e.*, at the rate of $2\frac{1}{2}$ cwt. per acre).

All the above substances were applied on the afternoon of June 23rd, and on the following day the leaves of the turnips along the rows in each plot were carefully disturbed, when the following results were observed for each plot :—

In Plot I. (Paraffin and sand).—Practically no moths appeared.

In Plot II. (Lime-sulphur).—Several moths appeared.

In Plot III. (Paraffin and sand).—Very few moths appeared. Scarcely so good as for Plot I., but there were not so many moths disturbed as in Plot II.

In Plot IV. (Ground lime).—Practically no moths appeared.

In the other parts of the field, adjacent to the trial plots, large numbers of moths could be disturbed. The plots continued to be examined for several days afterwards, when it was observed that the moths were again beginning to be abundant in Plots I. and III., whereas they were still practically absent from Plot IV.

From the above it is evident that paraffin and sand, and ground lime have given good results in preventing egg-laying. The application of paraffin and sand, however, would have to be repeated to render this mixture effective, whereas the single application of ground lime had a lasting effect. Lime-sulphur has not given such good results as the other preparations.

It should be pointed out that an examination of the turnip leaves showed that no harmful results followed the dressing of ground lime.

With regard to the treatment of the turnips when the caterpillars are on the leaves, most benefit seems to have been derived from brushing the leaves by means of a "scuffler" to which branches were attached, or by some modification of this method. For example, Mr. Nichol, Adderstone Grange, Belford, adopted, with much success, the plan of fixing a pole in front of the scuffler with two bags hanging from the pole on each side (preferably containing a little sand or soil mixed with paraffin) in such a way that the bags brushed four drills of turnips. By this method the leaves of each drill were brushed four times during the operation of scuffling.

It was noticed by Mr. Morgan at Cockle Park, in 1914, that turnips, singled when the plants were small, suffered more from the caterpillar than when singling was done after good strong plants had developed. He also noticed that the last singled turnips suffered most, probably because the attack was more severe as the season advanced. Singling followed by heavy rains destroyed large numbers of caterpillars.

In one case starlings and plovers cleared the caterpillars from a badly attacked field of turnips in four days, after which the turnips grew vigorously, while in another case a turnip

field black with these birds eating the caterpillars showed no signs of the moth afterwards. Several reports state that rain stopped the caterpillars.

Near West Hartlepool coke fires were placed round headlands of infested turnip fields, and a large number of moths attracted by the light were killed (compare Miss Ormerod's account of the moths being attracted to lighthouses).

Practical Conclusions.—From the foregoing observations and results the following procedure is strongly recommended in dealing with this pest :—

A careful lookout should be kept, from the time when the turnips are ready for singling, for the appearance of the moth. It is small, being only about half an inch in length, and it can be readily recognised by the fact that on the posterior margin of the front wings there are whitish wave-like markings, so that, when the moth is at rest, and these two front wings meet, the markings form two or three diamond-shaped patches along the back. The hind wings, which bear fringes, are long and narrow, and of ashy grey colour. The antennæ are white, long and slender, and directed forward almost in two parallel lines.

Whenever the moth appears, $2\frac{1}{2}$ cwt. per acre of ground lime should be carefully broadcasted on the young turnips, preferably on a dewy morning when there is no wind. This lime dressing might also be applied if caterpillars of the moth develop, but at this stage brushing off the caterpillars, by a pole attached to the scuffer as already described, should at once be carried out. This latter operation should be repeated if necessary. By following this procedure it is believed that large areas of turnips were saved last season.

The large number of letters of application for advice received, especially from Northumberland and Durham, showed how widely the moth had become prevalent, and the Department was satisfied that the remedies suggested had considerable effect. Further, an excellent opportunity was afforded last year of giving advice as to the outbreak, and of getting particulars of its prevalence, owing to the fact that a very large number of farmers specially attended the stand conducted by the Agricultural Department of Armstrong College at two shows (one at Newcastle-upon-Tyne, and the other at Durham) with a view to consulting about the attack of the Diamond-back Moth.

The writer desires to thank Professor Gilchrist for advice and criticism in preparing the above notes and for the great practical interest he has shown in the trials which were carried out on turnips at Cockle Park with a view to preventing egg-laying by the moth.

EXPERIMENTS ON AMERICAN GOOSEBERRY MILDEW IN CAMBRIDGESHIRE.

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One of the complaints fruit growers make against tipping as a means of checking American gooseberry mildew is that the practice, if continued, sometimes tends to spoil the shape of the bushes. The purpose of these experiments, conducted during 1913-14, was, therefore, to ascertain whether some form of spraying or soil treatment carried out on a commercial basis could replace the present system of tipping. The garden chosen for the experiments was kindly placed at the disposal of the writers by Messrs. Chivers & Sons, of Histon, Cambridgeshire, with the permission of the Board of Agriculture and Fisheries; it was situated near Cambridge and contained full-grown gooseberry bushes (Whinham's Industry and Keepsake) interplanted with top fruit. It is regrettable that two varieties were present in the experimental area, but a sufficiently large homogeneous plantation could not be obtained at a convenient place. Since the introduction of American gooseberry mildew into Cambridgeshire the garden has always been one of the most heavily infected in the county, especially as regards the fruit. In October, 1913, 21 plots, each about $\frac{1}{2}$ -acre in extent, and one plot, No. 22, the area of which was more than 1 acre, were chosen for the experiments. Plots 1-3 and 12-22 were planted with Whinham's Industry, plots 5-10 with Keepsakes, and plots 4 and 11 half with Whinham's Industry (4A) and half with Keepsakes (4B). The bushes remained untipped after the summer of 1913. At the end of October, 1913, the amount of disease on each plot was estimated separately according to the Board's scale as "very few, very slight" * but for the whole garden the estimate was "common, very slight" *; in order to increase the opportunity for infection the following spring, additional twigs bearing perithecia were scattered on each of the plots during November. All the plots except No. 14 were dug over during the winter. The plots were treated as follows:—

Plot 1. *Sprayed with Lime Sulphur* (spec. grav. 1.005).—On March 31st, April 27th, and July 16th.

* We are indebted to Mr. F. G. Titcher, Sub-Inspector of the Board of Agriculture, for these estimates, and for being the first to find the summer stage in the plots.

- Plot 2. *Lime Sulphur in Powder Form applied to Bushes in Early Morning.*—On April 3rd (almost all washed off by rain on April 7th), April 29th, and July 16th.
- Plot 3. *Sprayed with Bordeaux Mixture.*—On April 1st, April 28th, and July 17th.
- Plot 4. *Bordeaux Mixture applied in Powder Form in Early Morning.*—On April 2nd (partly washed off by rain on April 7th; scorching of leaves subsequently apparent), April 29th, and July 17th.
- Plot 5. *Sprayed on February 20th with Lime Sulphur + Lime.*—This plot was divided transversely into A and B. A received a heavy dressing of farmyard manure during the winter, B was not manured.

The spray was prepared as follows:—To 1 cwt. of lime, mixed thoroughly with 100 gal. of water, $2\frac{1}{2}$ gal. of a stock solution of lime sulphur of spec. grav. 1.047 were added, the spec. grav. of the resulting lime sulphur + lime being 1.053. This spray was used because it was strongly recommended as a winter wash by a commercial firm.

The buds had opened when the bushes were sprayed. Rain fell the night after spraying.

- Plot 6. *As in plot 5, but Lime Sulphur only used.*—This plot was also divided transversely into A and B and treated as in plot 5 as regards manuring.

The lime sulphur solution was made by adding 20 gal. of water to 1 gal. of the lime sulphur solution used in plot 5, which gave a solution of spec. grav. 1.0025. This strength is of course much too low for a winter spray, but was used as a partial control for the spray used in Plot 5. Heavy rain fell after spraying.

- Plot 7. *Sprayed on February 9th with 1 per cent. Commercial Formalin.*—Buds were swelling when the spray was applied. Rain fell two days after spraying.
- Plot 8. *Sprayed on February 9th with a Solution of Sulphate of Copper.*—Plot divided transversely into A and B. A was sprayed with 1 per cent. solution, B with a 2 per cent. solution. Other remarks as in Plot 7.
- Plot 9. *Sprayed on December 8th, 1913, with a Solution of Sulphate of Copper.*—Plot divided transversely into A and B. A sprayed with a 2 per cent. solution, B with a 4 per cent. solution.
- Plot 10. *Sprayed with a $2\frac{1}{2}$ per cent. Solution of Caustic Soda.*—Plot divided transversely into A and B. A was sprayed on December 8th, 1913, and B on February 9th, 1914.
- Plot 11. *Soil treated with Kainit at rate of 4 cwt. per acre.*—Half of the kainit was applied in November, 1913, and forked in, and the remainder in March. Considerable scorching of the leaves was noticed in April.
- Plot 12. *Soil treated with Sulphate of Iron at the rate of 2 cwt. per acre.*—Half of the sulphate of iron was applied in November, 1913, and the remainder added in March, 1914. Many dead leaves were evident in April.
- Plot 13. *Soil dug over during Winter as in all other Plots except 14.*
- Plot 14. *Soil not dug during Winter.*

- Plot 15. *Bushes heavily dressed with Farmyard Manure during Winter.*
 Plot 16. *As in Plot 15, but Bushes sprayed as in Plot 1.*
 Plot 17. *Soil treated with Basic Slag at rate of 10 cwt. per acre. —Half applied in November, 1913, and the other half in February, 1914.*
 Plot 18. *As in Plot 17, but half (A) sprayed with Lime Sulphur as in Plot 1, half (B) sprayed with Bordeaux Mixture as in Plot 3.*
 Plot 19. *Sprayed three times with a 0.2 per cent. or 0.1 per cent. Solution of Sulphuric Acid. —The first spraying on April 28th with a 0.2 per cent. solution caused scorching of the foliage, so a 0.1 per cent. solution was used on May 16th and June 8th. Heavy rain fell soon after the last spraying.*
 Plot 20. *Sprayed with Lime Sulphur on same Dates as in Plot 1. —Plot divided transversely into A and B. A sprayed with lime sulphur of spec. grav. 1.01, B sprayed with lime sulphur of spec. grav. 1.0025.*
 Plot 21. *Sprayed heavily during middle of February with a Solution of Sulphate of Iron so that whole area of Soil was well soaked. —Plot divided transversely into A and B. A sprayed with a 5 per cent. solution, B with a 10 per cent. solution. Buds were forward. Rain fell 30 hours after spraying.*
 Plot 22. *Control.*

Results.—The summer stage of the disease was first found on April 6th on a few bushes in each of plots 17, 19, and 22. On April 23rd traces of the disease were found on a few bushes in plots 1, 3, 12, 13, 14, 15, 16, 17, 18, 19, 21 and 22. On May 2nd disease, chiefly on the berries and varying in amount, was present on all plots except 4, 7, 8, 9 and 10. All of these plots, except one half of plot 4, consisted of Keepsakes, the fruit of which is less susceptible to attack in Cambridgeshire than that of Whinham's Industry. A week later disease was present in all plots, but there was considerably less disease on the plots containing Keepsakes ("few to many, very slight") than on most of the plots consisting of Whinham's Industry ("very many, general to bad"); this was attributed to the greater resistance of the former variety. On the other hand, Whinham's Industry which had been sprayed or dusted twice with lime sulphur or Bordeaux mixture were marked "very many, slight" at the same time. A difference between the sprayed and unsprayed Whinham's Industry remained apparent until about May 16th. Between May 9th and May 16th, the Whinham's Industry which had been heavily dressed with farmyard manure the previous winter, and had consequently made greater growth, began to be more affected than those unmanured. By May 22nd all plots of Whinham's Industry were affected to practically the same extent, each plot being marked "very many, bad to very bad" with the exception

of plots 4A and 20A, treated respectively with powdered Bordeaux mixture and lime sulphur of spec. grav. 1.01 which were marked "very many, general." From this date onwards the disease was so generally distributed that the previous treatment exercised no influence on the condition of the plots. The extremities of many young shoots were killed by the mildew.

All treatment was carried out under strict supervision, and doubtless the spraying, for which knapsacks were used, was more carefully done than could often be the case in commercial plantations.

Last year the summer stage of American gooseberry mildew was particularly prevalent on the fruit throughout the country, so that the experiments were carried out under severe conditions.

Conclusions.—1.—Spraying twice in the early part of the spring with lime sulphur or Bordeaux mixture checks the development of the disease to a slight extent, but, in the opinion of the writers, the cost of application is not repaid by the small measure of protection afforded.

2.—All forms of soil treatment and winter spraying that were tried appeared to be valueless in checking the disease during the following season.

3.—Heavy applications of farmyard manure favour the disease by encouraging an abundant succulent growth. This fact has been recognised for some time but it is desirable to reiterate it.

4.—As a corollary of (1) and (2) it follows that tipping is the only practical means known at present of reducing the amount of disease. As is well known, on account of the rapid fall of the perithecia from the shoots, this is best carried out early in the autumn. Bushes should be tipped as soon as danger of renewed growth is past, the early part of September being usually the best time for the purpose. In order to preserve the shape of the bushes as far as possible, shoots free from disease should not be tipped and the centre of the bushes should be thinned out during the winter. In view of the formation of perithecia on the berries as early as May it is important to destroy all diseased fruit as soon as possible.

SOME IRISH LARCH PLANTATIONS.

J. H. WADDINGHAM.

THE following is a continuation of an article dealing with larch woods on the Shanbally Estate, Co. Tipperary, which was published in this *Journal* for May, 1914, p. 116.

1. *General Description of Sylvicultural Conditions.*—The woods described lie on the Galtee Castle Estate, the property of Mr. J. Buckley. They are situated on the western side of the Attychraan River, which runs from north to south in the Galtee Mountains and forms a landlocked glen containing some 500 acres of larch woods.

The climatic and general soil conditions are similar to those described for the Shanbally Estate, but on the outer hills the soil is frequently very shallow, stony and poor, whereas in the glen it has a depth of 10 feet even at high elevations.

The ideal conditions for the growth of larch are a rich, deep, moist, well-drained soil, preferably on a steep bank into which the roots can easily penetrate, a moist atmosphere and shelter from all winds when the elevation reaches about 700 feet.

In such a situation in the Galtees, at an elevation of 700 feet, is a wood 45 years of age, with a height of about 73 feet, volume of 5,000 cubic feet per acre, and, allowing 1,000 cubic feet for a thinning made in 1907, a mean annual increment of about 130 cubic feet per acre per annum.

2. *Method of Measurement.*—Plots of pure larch were selected in two series of woods, one being about 25-30 years of age and the other about 55 years of age. The extremely dense woods on the estate were not selected on account of difficulties of measurement.

The volume of the main crop has been arrived at by the methods detailed in the former article.

The writer desires to express his obligation to Mr. W. R. Hickley, Agent, Galtee Castle, for permission to measure these sample plots and publish the results.

SUMMARY OF SAMPLE PLOTS.

Plot.	Age, years.	No. of trees, per acre.	Sample trees.					Conditions of Growth.	
			Mean diam., in.	Vol. per acre, cub. ft.	Height, ft.	Diam., in.	Form factor.		Volume, cub. ft.
No. 1 Kennel Plantation	38	522	7.0	3,461	49	6.6	0.500	6.13	Soil : Well-drained, sandy loam. Aspect : Gentle southern slope. Elevation : 800 feet.
No. 2	58	270	11.3	6,360	73	12.25	0.467	27.93	Soil : Covered with grass, ferns and wood anemone. Aspect : Gentle eastern slope. Elevation : 730 feet.
No. 3	31	795	5.6	2,528	41	5.15	0.446	2.65	Soil : Deep loam. Aspect : East. Elevation : 900 feet.
No. 4	31	670	5.7	2,228	41	5.4	0.454	2.96	Soil : Deep loam covered with grass, moss and ferns. Aspect : Gentle eastern slope. Elevation : 900 feet.
No. 5	27	820	5.3	2,180	36.5	5.4	0.477	2.77	Soil : Deep loam. Aspect : Hill top exposed to all quarters except north. Elevation : 1,000 feet.
No. 6	27	880	5.1	2,100	34.5	5.1	0.486	2.38	Soil : Deep loam covered with moss and grass. Aspect : East. Elevation : 990 feet.
No. 7	28	820	5.5	2,632	40	5.1	0.478	2.71	Soil : Deep loam covered with grass. Aspect : Medium eastern slope. Elevation : 940 feet.
No. 8	28	710	5.2	1,876	37.5	5.0	0.477	2.44	Soil : Deep loam covered with grass and moss. Aspect : Steep eastern slope.

Soil : Well-drained, sandy loam.
Aspect : Gentle southern slope.
Elevation : 800 feet.

Soil : Covered with grass, ferns and
wood anemone.
Aspect : Gentle eastern slope.
Elevation : 730 feet.

Soil : Deep loam. Aspect : East.
Elevation : 900 feet.

Soil : Deep loam covered with grass,
moss and ferns.
Aspect : Gentle eastern slope.
Elevation : 900 feet.

Soil : Deep loam.
Aspect : Hill top exposed to all
quarters except north.
Elevation : 1,000 feet.

Soil : Deep loam covered with moss
and grass.
Aspect : East.
Elevation : 990 feet.

Soil : Deep loam covered with grass.
Aspect : Medium eastern slope.
Elevation : 940 feet.

Soil : Deep loam covered with grass
and ferns.
Aspect : Steep eastern slope.
Elevation : 1,000 feet.

DETAILS OF MEASUREMENTS OF SAMPLE PLOTS.

DIAMETERS CALLIPERED at 4 ft. 3 in.

Sample Plot No. 1. Kennel Plantation. Area=0.4 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.
5	22	3.0008	} Nil.	Nil.
6	57	11.1891		
7	70	18.7110		
8	43	15.0113		
9	18	7.9524		
10	—	—		
11	1	0.6600		
Total ..	211	56.5246		

Sample Plot No. 2. Area=0.3 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.
7	2	0.5346	} Nil.	Nil.
8	4	1.3904		
9	13	5.7434		
10	17	9.2718		
11	9	5.9400		
12	14	10.9956		
13	13	11.9834		
14	5	5.3450		
15	4	4.9088		
Total ..	81	56.1190		

Sample Plot No. 3. Area=0.2 acre.

Diameter Class.	Dominant Crop.		Minor Crop.		Spruce and Scots Pine.	
	No.	Basal Area.	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.		sq. ft.
4	7	0.6111	14	1.2222	—	—
5	77	10.5028	14	1.0096	2	0.2728
6	53	10.4039	3	0.5880	4	0.7852
7	20	5.3460	2	0.5346	1	0.2073
8	1	0.3491	—	—	1	0.3491
9	1	0.4418	—	—	—	—
Total ..	159	27.6547	33	4.2553	8	1.6744

Sample Plot No. 4. Area = 0.1 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.
4	1	0.0873	4	0.3492
5	30	4.0920	5	0.6820
6	27	5.3001	—	—
7	8	2.1384	1	0.2673
8	1	0.3491	—	—
Total ..	67	11.9669	10	1.2985

Sample Plot No. 5. Area = 0.1 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.
3	—	—	1	0.0491
4	18	1.5714	11	0.9603
5	34	4.6376	6	0.8184
6	24	4.7112	—	—
7	6	1.6038	—	—
Total ..	82	12.5240	18	1.8278

Sample Plot No. 6. Area = 0.1 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.
3	—	—	3	0.1473
4	21	1.8333	5	0.4305
5	46	6.2744	6	0.8184
6	19	3.7297	—	—
7	—	—	—	—
8	2	0.6982	—	—
Total ..	88	12.5356	14	1.4022

Sample Plot No. 7. Area = 0.1 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.
4	7	0.6111	8	0.6984
5	39	5.3196	2	0.2728
6	26	5.1038	—	—
7	9	2.4056	—	—
8	1	0.3491	—	—
Total ..	82	13.7892	10	0.9712

Sample Plot No. 8. Area = 0.1 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	No.	Basal Area.	No.	Basal Area.
in.		sq. ft.		sq. ft.
3	—	—	20	0.9820
4	20	1.7460	4	0.3492
5	28	3.8192	3	0.4092
6	17	3.3371	—	—
7	6	1.6038	—	—
Total ..	71	10.5061	27	1.7404

THE conclusion of the enquiry of the Royal Commission on Sewage Disposal with the presentation of their Final Report affords an opportunity for reviewing the position as regards the use of sewage sludge as manure.*

Small amounts of human excreta are of course applied to the land as such, with or without some preliminary treatment, but the fact that a water-borne system of sanitation is almost everywhere prevalent necessitates the use in some way of sewage as manure if the valuable manurial ingredients of human excreta are not to be allowed to go to waste. Sewage has found application on sewage farms for crops such as cabbages, turnips, mangolds and grass. Its employment in this way, however, has been limited, since large volumes of liquid have to be dealt with, of which even the best-adapted soils can absorb only relatively small quantities, so

* Royal Commission on Sewage Disposal—Fifth Report (Cd. 4278. Price 2s. 9d.), and Appendix VIII to Fifth Report (Cd. 4286. Price 3d.). Also Appendix to Ninth Report (Cd. 7820. Price 1s. 4d.).

that considerable areas of land are necessary ; and sewage farming in general does not seem to have been a great commercial success.

A further method of utilising the manurial ingredients of sewage, to which much attention has been given, is the application of sewage "sludge" to the land. At the sewage works where the sewage is treated for purification the coarser solids are first removed ; after this the finely divided matter in suspension is removed either by sedimentation, or precipitation with chemicals, or septic treatment. The "sludge" is the sediment so obtained, and in view of its content of nitrogen, phosphorus and a small amount of potash, attempts have been made to utilise this product as manure.

It has been found that the most convenient way of disposing of this sludge is to press it into a "cake" after mixing it with lime. In some cases a charge of about 6*d.* per ton is made for it, but in others the sludge is given away to neighbouring farmers or a small fee may even be paid for its removal.

Speaking generally, properly pressed sludge when in the form of a solid cake does not give rise to serious nuisance from smell, and if exposed to the air in dry weather it soon becomes entirely inoffensive. It has, however, a slight smell of fresh sewage, and if kept moist, *e.g.*, if it is exposed to the air during wet weather, it soon becomes putrid and gives rise to offensive odours. For this reason it should, if possible, be stored under cover until it can be distributed on the land, or covered in.

The composition of the pressed cake varies according to its origin ; in addition to its manurial constituents it naturally contains a good deal of lime. The actual market value, however, is insignificant owing to the relatively high cost of carriage upon a mixture containing of necessity a large proportion of water, grit and carbonaceous matter.

Experiments with regard to the use of various sewage sludges in agriculture were first carried out for the Royal Commission on Sewage Disposal about ten years ago.

Professor Somerville's trials with turnips, mangolds and swedes at five centres did not reveal any consistent manurial effect from the sludge ; and the conclusion was drawn that the nitrogen and phosphoric acid of sludge are in a much less available form than the same substances in sulphate of ammonia, superphosphate and fish meal.

In experiments carried out by Mr. Middleton on grass at eight centres the application of the sludge seems to have been useful for the hay crop in the north where the wet summer

experienced favoured slow-acting manure, but the sludge produced no results in the south of England. The conclusions were drawn that, for root crops and grass, the action of the nitrogenous and phosphatic constituents of sludge is very slow as compared with the effect produced by nitrogen and phosphates supplied in ordinary artificial manures; that sewage sludge would not appear to be well adapted for such crops as mangolds, potatoes and swedes, which have a short period of growth and require quick-acting manures, and if employed it should be applied in tons rather than in hundredweights per acre; that proper quantities of sludge would be likely to form a good dressing for the slow-growing plants of many permanent pastures and meadows; and that sludge is unlikely to give satisfaction on the very poor clay-soil pastures which are so much benefited by basic slag.

Dr. Voelcker found in pot-trials with wheat that those sludges did best which contained most moisture and most lime, but that high amounts of organic matter and of total nitrogen did not produce a correspondingly good result, while all the sludges tried were somewhat inferior to artificial manures supplying equal amounts of approximately like ingredients. An increase of 10 to 12 per cent. in corn and in straw over the unmanured produce was, on the average, obtained, as against one of 16 to 17 per cent. with artificial manuring. Based on the extra produce obtained the best of the sludges was valued at 10s. a ton delivered on the land.

The experiments for the Royal Commission on Sewage Disposal did not end with the above trials, owing to the subsequent discovery of an efficient process for "de-greasing" the sludge. It must be explained that natural sludge contains a large amount of grease and soapy matter (equal to from 10 to 15 per cent. of the dry matter). Grease is of no value as manure and, in fact, is supposed to exercise a retarding influence by preventing the ready decomposition of the organic and nitrogenous matters with which it may be mixed.

The effect of these "de-greased" sludges was compared with that of natural sludges on wheat at Woburn and on hay and oats at Rothamsted in 1913-14.

At Woburn the natural sludge was found to contain more moisture, more nitrogen and more soluble nitrogen than the de-greased, an application of 1 ton per acre supplying 45 lb. of nitrogen in the case of natural sludge and 40 lb. in the case of de-greased sludge. The following table shows the yields of grain and straw from various dressings:—

Treatment.	Weight of Produce (untreated = 100).	
	Corn.	Straw.
Untreated	100	100
Natural sludge :		
1 ton per acre	122	102
2 tons per acre	120	112
1 ton per acre + $\frac{1}{2}$ ton lime ..	132	110
De-greased sludge :		
1 ton per acre	101	107
2 tons per acre	118	102
1 ton per acre + $\frac{1}{2}$ ton lime ..	122	111
Lime only— $\frac{1}{2}$ ton per acre ..	113	102

Thus the average increase in grain over the untreated produce was 25 per cent. with the natural sludge and 14 per cent. with the de-greased. The best results were obtained with lime, but that this was not due to lime alone is shown by the yields where lime was applied without sludge.

At Rothamsted, also, the nitrogen content of the natural sludge (1.76 per cent.) was found to be above that of the de-greased sludge (1.55 per cent.), while the content of phosphoric acid was 0.85 and 1.33 per cent. respectively.

In the grass experiments the manures were applied at the uniform rate of 20 lb. of nitrogen per acre (equivalent to about half a ton of sludge) with the following results :—

Treatment.	Yield of Hay per acre. cwt.
Untreated	17.64
Natural sludge	18.64
De-greased sludge	16.29
Calcium cyanamide	21.59
Nitrate of soda	25.93

The effect of the sludges was negligible. It should be mentioned that the season was a distinctly dry one.

Experiments with oats were carried out on the same plan, but from neither of the sludges was so good a return obtained as where no treatment was given, the sludges being applied so as to supply 16.67 lb. of nitrogen per acre.

The results of the Rothamsted experiments are taken to indicate the lack of evidence to the effect that the removal of the fat from the sludge increases the ease of decomposition in the soil.

The point towards which laboratory and other experiments should in future be directed seems to be the discovery of some method of rendering the nitrogenous matter of the sewage sludge more readily available as plant food than at present.

MALT culms or coombs consist of the rootlets or shoots thrown out by barley during its conversion into malt. These rootlets and shoots, which in amount represent

Malt Culms. about 3 per cent. of the original barley, are separated by screening and afterwards dried. The best quality malt culms are about $\frac{1}{4}$ in. in length, are light in colour, and are slightly curled, crisp, and thread-like in appearance. They possess a pleasant, aromatic smell when moistened with water, and should be almost free from dust. In recent years the bulk of the malt culms produced in this country has been exported. This is not the case at present, and farmers will do well to consider the possibility of using them freely in the rations fed to their stock. At present prices they should prove an economical feeding stuff.

Composition.—Malt culms in themselves vary widely in composition, and as this variation is often accentuated by the presence of a quantity of more or less malted barley kernels, the average analysis may not always afford a reliable indication of the contents of a particular sample. In general, however, it may be said that malt culms are characterised by a high albuminoid content, little fat and a deficiency of lime in the ash. The following are the averages of a number of analyses carried out in the United States, Germany and England respectively :—

—	Dry matter.	Album. inoids.	Fat.	Carbo- hydrates.	Woody Fibre.	Ash.
—	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
United States ..	89	26.4	1.3	43.1	12.3	5.9
Germany ..	90	24.4	2.0	42.4	14.0	7.2
England (Smetham)	90.2	26.28	1.03	45.96	11.08	5.85

The high proportion of albuminoids present would seem to indicate that malt culms should be placed in the same category as the leguminous seeds and oil cakes. It is found, however, that a considerable portion of the total albuminoids is in the form of amides which possess a relatively low nutritive value. In five analyses of malt culms with albuminoid contents ranging from 22.35 to 34.5 per cent., Kellner found that only 17.29 to 25.64 per cent. of the albuminoids were in the form of true albuminoids. On the other hand experience has shown that malt culms are highly digestible. Experiments carried out by

Wolff, Kuhn and Armsby showed that when fed to sheep 81 per cent. of albuminoids, 68 per cent. of fat, and 76 per cent. of carbohydrates contained in the culms were digested, and that when fed to pigs the corresponding percentages were 75 of albuminoids, 65 of fat and 85 of carbohydrates.

Malt culms form an excellent supplementary food for all kinds of farm stock, especially for dairy cows and sheep. They stimulate digestion and are usually eaten with relish. It should be pointed out, however, that the feeding of large quantities, especially in the dry form, is apt to cause digestive troubles, and even abortion in the case of breeding animals. The best results are obtained by feeding moderate quantities in mixed rations.

Dairy Cows.—Malt culms may perhaps be used with the greatest advantage for feeding dairy cattle. Their effect on both the yield and quality of the milk is favourable and they produce well-flavoured butter. The culms should partially replace concentrated foods, and may be fed in conjunction with straw chaff, and succulent green food. Occasionally culms are not relished by cows at first, but, if gradually introduced into the ration, they will soon be readily eaten. Up to 3 or 4 lb. per head per day may be fed without risk. When fed at the higher rate it is usually advisable to steep them in boiling water before using.

Adult Cattle.—Malt culms may also be usefully fed up to 5½ lb. per day to cattle during the first part of the fattening period. During the later stages of fattening they are not always willingly eaten. The culms should be steeped in water. A ration composed of malt culms, brewers' grains and straw chaff has been fed with advantage.

Calves.—After calves have reached the age of 3 months, malt culms may be gradually introduced in place of milk. It is recommended that they should be thoroughly moistened with boiling water and fed when lukewarm. Not more than a pound or two should be fed before the calves reach the age of 6 months, but afterwards they may be fed at the rate of 2 to 3 lb. for every 200 lb. live weight.

Horses.—Malt culms have been successfully utilised as a partial substitute for oats in rations for horses without in any way reducing the working capacity. The best plan is to commence with a small amount, say ½ lb., and gradually increase it. Up to 6 lb. of culms may be fed in the dry form, and if supplemented with oats and chaff will provide a useful ration.

Foals, also, may receive small quantities along with crushed oats.

Sheep.—Sheep may receive malt culms at the rate of $\frac{1}{2}$ lb. per 100 lb. live weight. They should be fed dry with straw chaff, and succulent green food. Lambs will also thrive well on a mixture of malt culms, crushed grain and chaff.

Pigs.—From $\frac{1}{2}$ lb. up to about $2\frac{1}{2}$ lb. per head of malt culms according to age and size, may be fed to fattening pigs. The culms make a good ration fed with skim milk. In America a mixture of malt culms and molasses is often used with good results. Culms are said to be unsuitable for breeding sows.

Poultry.—Small quantities of malt culms may be fed to hens.

Malt culms are best fed in a fresh condition as they are then more easily digested than when stale. When stored care should be taken to keep them in dry, airy and dust-free places. They easily absorb dust and moisture from the atmosphere, and, in consequence tend soon to develop moulds and fungoid growths. Damaged culms may lead to abortion in breeding animals and inflammation of the digestive organs in calves and pigs. Samples of dark brown culms should also be avoided; they either contain harmful products of decomposition owing to fermentation while damp or are indigestible on account of the steeping process being carried out too rapidly. Provided, however, that care is taken to obtain only malt culms of good quality, free from foreign matter, farmers will find in them a valuable feeding stuff which will form an economical and efficient substitute for many of the concentrated feeding stuffs at present in use.

RENNET, as used for the purposes of cheese-making, is a liquid or powdered preparation containing the rennet ferment which is a secretion of the rennet glands

Home-made Rennet in the lining of the stomach, and is found
Extract. in most animals. The rennet ferment

exerts a powerful action on the caseous matter of milk, and its function in the stomach, where it occurs in the gastric juice as *rennin*, is to cause curdling of the milk ingested; thus the ferment is especially abundant in the stomachs of young animals while still suckling, and is present in the greatest amount when a meal has just been digested. For the preparation of rennet extract the stomachs of calves, known commercially as "vells," are almost exclusively employed on account of the ease with which they can usually be procured. A calf fed on milk secretes enough gastric juice

in a day to coagulate 10 gallons of milk in one minute. As soon as its food, however, is changed to cereal products and grasses, the composition of the juice changes to meet the new requirements, and is no longer so powerful for dealing with milk.

Very little rennet is now manufactured in this country, and cheese-makers have for some time been largely dependent on the supplies from Denmark and Holland. Since the outbreak of war the supplies have been short and very difficult to obtain, and, while there appears to be little danger of a great shortage, prices have advanced considerably, so that for commercial rennet solutions 10s. to 12s. 6d. per gallon has been charged in place of a normal price of from 7s. to 8s. One reason for the shortage apparently lies in the fact that a large proportion of the rennet extract was prepared from Russian vells, which are not now available.

The Board have received information that one firm, who are large importers of and wholesale dealers in rennet, are making arrangements for the collection of vells and the manufacture of rennet in this country, and they anticipate that before long the supply will be increased, and that prices will fall considerably. Nevertheless, since there appears to be a possibility that farmers will experience some difficulty in obtaining supplies from the usual sources at normal prices, it may be useful to deal briefly with a few methods of preparing a home-made rennet extract.

Drying the "Vells."—For the reasons stated above, the "vells" of sucking or milk-fed calves only should be used. When the calf is killed, the fourth or digestive stomach should be removed immediately, leaving a small portion of the third stomach attached. The contents should be squeezed out, but, in order to avoid loss of the rennet ferment, the stomach should not be turned inside out or washed internally. The larger end of the stomach should then be tied, and the stomach blown up hard, after which the narrow end should be tied at the neck. It may be hung to dry in a draughty shed or in a warm, dry room, but it should not be subjected to undue heat or hung in the open, exposed to the sun. The drying should not take more than a week or there is a risk of putrefaction. The neck should then be removed, after which the vell is ready for use.* The vell may with advantage be sprinkled with salt previous to being dried.

Preparation of Rennet Extract from the Dried "Vells."—Before the extensive introduction of commercial rennet

* *Agricultural Gazette of Canada*, March, 1915.

extract, the rennet was usually prepared in the cheese factory. Before being dried, the vells stood for some hours first in pure water and then in water rendered sour with acid whey or citric acid at a temperature of 68–95° F. They were sometimes preserved by the addition to the soaking liquid of salt, spirits of wine, pepper, saltpetre, herbs, etc. Occasionally the vells were finely minced and treated with 5 per cent. of salt and pepper. The mass was then dipped in vinegar, and after 8 or 12 hours mixed into a paste by the addition of buttermilk and made into balls as large as the fist, which were left for 3 to 4 weeks in a warm, dry place, slightly smoked, and kept until required.

A method of preparing rennet recommended by Sheldon* is as follows :—A brine solution, consisting of 1 part of salt to 20 parts of water, is boiled for half an hour, and when it is cold 6 rennet skins are added to every 2 gallons of the liquid. The skins are left in the liquid for a month, during which time they are gently rubbed several times between the hands. At the end of a month the skins are removed from the liquid, which is then ready for use, and will keep good for a long period if air is excluded. Sheldon mentions another method in which salt brine capable of floating an egg is made. To every gallon of this 4 vells, $\frac{1}{2}$ oz. of saltpetre, and half a lemon sliced are added. The liquid is ready for use after a month.

A recipe devised by Soxhlet† is to cut up the vells into small pieces, and for every 1 lb. of skin, 1 gallon of water, $\frac{1}{2}$ lb. salt, and $6\frac{1}{2}$ oz. of boracic acid are taken. The mixture is then left to stand for 5 days with frequent shaking. To every gallon of water used a further quantity of $\frac{1}{2}$ lb. of salt is added, and the solution is then filtered. The cost of the extract per gallon, assuming that about 15 vells are used, was estimated by Soxhlet to be about 3s. 6d.

According to Oliver,‡ the best method of preparing rennet extract is to use boiled and filtered rain-water, in which mineral impurities are in the least possible proportion, and to add as much salt as can be dissolved, the vells being immersed, when the liquid has cooled, at the rate of 4 to every gallon. He states that brine, though a good preservative, does not extract the full strength of the skins, and 8 vells once soaked will make a second gallon of steep. Experiments have been made to test the advantage of steeping the vells in boiled and filtered water for several days, in order to secure more complete extraction, and then saturating the steep with salt. Fermentation frequently set in, and the after-salting did not render harmless the foul effects of the fermentation.

Dairying, by J. Prince Sheldon. † *The Book of the Dairy*, by W. Fleischmann.
‡ *Milk, Cheese and Butter*, by John Oliver.

Another method is to cut the vells into small pieces, steep them in a 5 per cent. solution of brine, and stir and pound well at intervals for a week. The liquid should then be removed and replaced by more brine, with the repetition of the treatment for a further week.

Home-made extract of rennet may be filtered through clean straw, sand and charcoal; it should be dark in colour but should be clear, and free from turbidity, which is a sign of the beginning of decomposition. Preservatives may be added to the extract, but according to Fleischmann they increase the keeping properties of the solution at the expense of its strength, since they render a portion of the rennet ferment inactive.

Rennet powder is obtained by adding an excess of salt to the rennet solution. The rennet is thus precipitated and after drying the precipitate, a powder is obtained consisting essentially of the ferment, together with other organic matter and a considerable amount of salt.

A practice which appears to be adopted in some farmhouse is to put a piece of rennet skin in to soak each day for the next day's use. By this plan, however, the strength is not thoroughly extracted from the skin, and the liquid, though fresh, is not uniform in quality from day to day. The method of making a steep in whey is also not to be recommended, as it is liable to lead to undesirable forms of fermentation.

THE Irish pig-breeding industry brings in an average annual gross return of about £8,000,000. On an average over 1½ million pigs are handled annually by Irish curing firms, and approximately four-fifths of the cured bacon and hams are exported, Great Britain deriving about one-fifth of its imports of bacon and hams

from Irish sources. Further, in normal seasons over 300,000 head of pigs are annually shipped alive from Ireland, the bulk of them being known as "heavy weights" (of from 2½ cwt. to 3 cwt. in weight) and being shipped in the late autumn months, while the lighter weights are known as "sizeable"; there is also a considerable export of dead pigs from Ireland.

A Small Holder's Industry.—The industry in Ireland is essentially that of small holders, the reason being that larger farmers are hampered by the scarcity of labour and chiefly devote their attention to the raising of store cattle or to beef production. The family of the small holder supplies cheap

* Summarised from the Report of the Departmental Committee, appointed by the Department of Agriculture and Technical Instruction for Ireland on the Irish Pig-Breeding Industry [Cd. 7890].

labour, in addition to which the tillage carried on on small farms enables the holder to provide quantities of home-grown foods which can be utilised to great advantage by being fed to pigs. The keeping of pigs by farm labourers, and indeed by the labouring classes generally, seems to be decreasing; this is partly due to an unwillingness to engage in the work of looking after the pigs after working hours or on Sundays, partly to lack of housing accommodation, partly to sanitary restrictions in towns, and partly to the substitution of poultry and eggs for pigs under the impression that the former are more profitable.

Breeds.—The class of animal reared in Ireland has undergone a marked improvement as a result of the selection work carried on by breeders; not only has the quality of the product increased, but the animals are finished in shorter time and on a smaller amount of food than was formerly the case.

Under a scheme of the Department of Agriculture and Technical Instruction for Ireland premiums are given in respect of boars of approved breeds of £5 in the first year (this is reckoned to be equal to the purchase price), and of an additional £3 if the animals are kept until the second year; in 1914 premiums were given in respect of 563 boars, *i.e.*, about one-quarter of all the boars in the country. The breeds subsidised are the Large Yorkshire and the Large White Ulster. The popularity of the Large Yorkshire is due to the fact that it is an extremely thrifty animal which makes a nice bacon pig at an early age and meets fully the requirements of the London and south of England markets. For the long side trade a well-ribbed pig which will give a carcass showing a high proportion of lean meat and not carrying too much fat is required; the curers in the south of Ireland have found the most suitable animal in the cross of the Large Yorkshire boar with the common type of sow found on Irish farms. Further advantages claimed for the Large Yorkshire pigs are that they are extremely hardy and that the thick skin enables the carcass to be transported for considerable distances without injury or discoloration, or to be singed without any risk of the skin cracking and the pork being injured.

The Large White Ulster is a heavier pig, with thin skin, and has the reputation of coming more quickly to a marketable weight in proportion to the food given than does the Large Yorkshire; owing to its deep side it specially meets the requirements of curers in the north of Ireland, who put their bacon on the market "rolled."

The Large Black is also kept, but is generally regarded with disfavour because the discoloration of the skin leads to smaller returns.

Fattening.—In Ulster young pigs of from 8 to 10 weeks old are put to fatten from weaning and reach $1\frac{1}{2}$ cwt. in four months, so that it is possible to turn out three finished lots in the year. This is considered the best method, and its adoption is being urged in place of that obtaining in the other three Irish provinces, where the young pigs are farrowed in the early spring months, run as stores during the summer, and only put to fatten when the potato crop becomes ready for use; under this latter system the animals are usually marketable as heavy weights during the winter months.

An elaborate series of feeding trials with pigs has been carried out by the Department of Agriculture and Technical Instruction for Ireland. These have shown:—

(1) That pigs can be fattened with less food in summer than in winter;

(2) That barley, pollards and maize produce practically the same live weight increases, and that barley produces a better quality of pork than maize;

(3) That approximately 5 cwt. of meal may be calculated to produce 1 cwt. of pork;

(4) That 20 cwt. of potatoes in a mixed ration will produce 1 cwt. of pork;

(5) That in a mixed ration 1 gall. of separated milk or buttermilk is approximately equal to 2 lb. of maize meal;

(6) That a larger increase of weight is obtained for the amount of food consumed in the early stages of fattening than in the later stages;* and

(7) That raw meal (*i.e.*, steeped in cold water for periods up to 12 hours) gives greater gains than cooked meal, there being no difference in the quality of pork produced.

The Irish Committee on the Pig Breeding Industry.—From 1851 to 1910 the number of pigs in Ireland remained fairly constant at about $1\frac{1}{4}$ million head, but the number has dropped seriously in recent years, viz., from 1,415,000 in 1911 to 1,060,000 in 1913. A committee appointed by the Irish Department of Agriculture and Technical Instruction to enquire into the subject found that the decline was due in particular to the low prices of pork prevailing previous to the enquiry, the high prices of feeding stuffs, and the poor yield of potatoes in 1912; as general causes preventing the desirable

* See also Dr. Crowther's article in this *Journal*, March, 1915, p. 1073.

continuity of the industry various difficulties connected with marketing (especially fluctuations in prices, which vary as much as 3s. per cwt. in a week) were indicated, in addition to the lack of labour and housing accommodation and the substitution of poultry for pigs.

The evidence given before the Committee showed conclusively that the farmers who obtain the best results are those who *regularly breed and feed* a certain number of pigs, and Irish pig breeders are therefore advised to discontinue their present practice of giving up pig breeding and feeding when pork prices are low and commencing again when the value of pork is high.

The Committee's recommendations include suggestions that the maximum value of the premiums given in respect of boars (see above) should be increased; that an increase in the value of the service fee should be considered; that the Department of Agriculture and Technical Instruction should annually import a limited number of high-class pure-bred boars from the most reliable herds in England, these animals to be either sold on reduced terms or leased at a small charge to breeders of premium boars; that power should be sought from Parliament to permit only such boars as are registered after inspection to stand at a service fee in Ireland; and that the Department should institute experiments as to the value of forage crops, such as vetches, rape, clover, &c., in order to ascertain if these crops can be utilised profitably for pig feeding.*

With regard to housing it is recommended that local authorities in Ireland should provide pigsties in connection with the cottages erected under their schemes; and that attention should be given to the improvement of pigsties on small holdings.

A system whereby bacon curing firms should inform feeders of the type of pig in demand and notify them from time to time regarding the weight of pigs likely to command the highest price is advocated.

It is thought that the Irish pig breeding industry will be in a very favourable position in the immediate future as a shortage in the pig supplies from Canada, the United States, Denmark, and the Continent generally, is anticipated.

* In connection with this subject see the Board's Special Leaflet No. 39.
The Use of Forage Crops for Pig Feeding.

THE table on p. 249 gives the prices per ton and per food unit of thirty-one feeding stuffs at London, Liverpool, Hull and

Bristol at the beginning of June. This table includes the same feeding stuffs as those dealt with in former notes already published in this *Journal*,* and is compiled on similar lines. For explanation of the meaning of the terms used, *e.g.*, *food units*, former notes should be consulted.

In the list below, the feeding stuffs are arranged in order of average price per food unit :—

	s.	d.	
Brewers' grains (wet)	0	11	per food unit.
Soya bean cake	1	3½	" "
Maize gluten feed	1	4½	" "
Coconut cake	1	5½	" "
Palm-nut kernel cake	1	5¾	" "
Decorticated cotton cake	1	6	" "
Brewers' grains (dry)	1	6½	" "
Linseed cake, Indian	1	6¾	" "
Malt culms	1	7¼	" "
Wheat pollards	1	7¾	" "
Linseed cake, English	1	8	" "
Wheat bran	1	8½	" "
Wheat middlings	1	8½	" "
Maize germ meal	1	9¾	" "
Wheat bran, broad	1	10¼	" "
Rice meal, Burmese	1	10¼	" "
Maize, Argentine	1	10¼	" "
Wheat sharps	1	10½	" "
Cotton cake, Egyptian	1	10¾	" "
Maize, American	1	11¼	" "
Cotton cake, Bombay	2	0	" "
Beans, Chinese	2	0	" "
Beans, English	2	0¼	" "
Peas, English dun	2	0½	" "
Maize meal	2	1¾	" "
Barley, English feeding	2	4½	" "
Peas, English maple	2	7	" "
Oats, Argentine	2	10½	" "
Peas, Calcutta white	2	11	" "
Oats, English	3	1½	" "

Comparison with last month's list shows that there is not on the whole much alteration in price. Brewers' grains

* March, 1915, p. 1111; April, 1915, p. 52; May, 1915, p. 148.

Feeding Stuff.	Reckoned from digestible nutrients.		Approximate prices per ton at the beginning of June.				Approximate price per Food Unit.			
	Nutritive Ratio.	Food Units.	London.		Liverpool.		Hull.		Bristol.	
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soya Bean Cake ..	1:1.1	122.3	8 18 9	10 5 0	8 7 6	7 15 0	7 15 0	8 4 1	8 4 1	8 4 1
Deodorized Cotton Cake ..	1:1.3	126.3	10 1 3	10 12 6	9 15 0	9 15 0	10 1 3	10 1 3	10 1 3	10 1 3
Indian Linseed Cake ..	1:1.5	123.1	10 1 3	10 12 6	9 15 0	9 15 0	10 1 3	10 1 3	10 1 3	10 1 3
Bombay Cotton Cake ..	1:2.0	120.1	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0
Egyptian Cotton Cake ..	1:2.4	75.3	6 12 6	7 0 0	6 17 6	6 17 6	6 12 6	6 12 6	6 12 6	6 12 6
Coconut Cake ..	1:3.8	103.6	6 0 0	7 10 0	6 10 0	6 10 0	6 0 0	6 0 0	6 0 0	6 0 0
English Kernel Cake ..	1:4.0	83.5	9 9 0	10 14 0	9 9 0	9 9 0	10 14 0	9 9 0	10 14 0	9 9 0
Chinese Beans ..	1:2.6	99.5	10 0 0	10 14 0	10 0 0	10 0 0	10 14 0	10 0 0	10 14 0	10 0 0
English Maple Peas ..	1:3.2	97.3	10 0 0	10 14 0	10 0 0	10 0 0	10 14 0	10 0 0	10 14 0	10 0 0
English Lup. Peas ..	1:3.2	97.3	10 0 0	10 14 0	10 0 0	10 0 0	10 14 0	10 0 0	10 14 0	10 0 0
Canadian Peas ..	1:3.2	97.3	10 0 0	10 14 0	10 0 0	10 0 0	10 14 0	10 0 0	10 14 0	10 0 0
American Maize ..	1:1.1	94.2	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0
Maize Meal ..	1:1.1	94.2	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0
Maize Germ Meal ..	1:1.1	94.2	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0	14 9 0
English Feeding Barley ..	1:2.8	83.0	8 17 6	9 0 0	8 15 0	8 15 0	8 17 6	8 15 0	8 15 0	8 15 0
English Oats ..	1:2.9	75.4	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
Argentine Oats (Buenos Ayres) ..	1:2.9	75.4	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
Malt (Crisp) ..	1:3.0	69.9	11 2 0	11 10 0	11 10 0	11 10 0	11 2 0	11 10 0	11 10 0	11 10 0
Brewers' Grains (dried) ..	1:3.0	69.9	11 2 0	11 10 0	11 10 0	11 10 0	11 2 0	11 10 0	11 10 0	11 10 0
Egyptian Rice (wet) ..	1:3.4	84.5	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0
Burmese Rice Meal ..	1:10.3	78.7	8 15 6	8 15 6	8 15 6	8 15 6	8 15 6	8 15 6	8 15 6	8 15 6
Wheat Middlings ..	1:5.3	93.4	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6
Wheat ..	1:5.3	80.3	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6
Wheat Bran ..	1:5.3	80.3	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6
Wheat Bran (broad) ..	1:4.7	79.9	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0

* Fine Sharps (Hilms)

have gone down, which is not surprising, as they are little used in summer when there is grass to be had for the cows. Coconut cake has gone up about a penny per unit. Our experience with it during the last month indicates that it does not keep well in warm weather, but is apt to develop a rancid smell and taste which makes it less acceptable to animals. Indian linseed cake has remained at 1s. 6 $\frac{3}{4}$ d. per unit, and at this price should be used in preference to other feeding stuffs for the several purposes indicated below. Dried grains have fallen, and may be used with advantage for some purposes. Both Egyptian and Bombay cotton cake have risen considerably, by $\frac{3}{4}$ d. and 1 $\frac{3}{4}$ d. per unit. Fortunately this dry season they can be replaced economically by linseed cake, which is now much cheaper per food unit than cotton cakes. The price of feeding barley and oats is still practically prohibitive. This is also the case with peas. The price of wheat offals may fall during the month if the fall in the price of wheat continues.* Considerable local variations in price still occur. Palm-nut kernel cake, for instance, costs only 1s. 2 $\frac{1}{2}$ d. per unit at Liverpool, which is 4d. per unit less than it costs in London, and 5 $\frac{1}{2}$ d. cheaper than at Bristol. Malt culms are dearest by several pence per unit at Liverpool.

It has been suggested that certain proprietary articles should be included in these notes, such as some of the mixed cakes and sugar feeds. There is a difficulty in adopting this suggestion, for such articles have no definite average composition on which an estimate of their content of food units can be based. Anyone who proposes buying such feeding stuffs can, however, make a rough calculation of the food units from the guaranteed analysis of the maker or seller, using the formula given in former notes.† From the number of food units thus calculated about one-fifth should be subtracted in order to get a rough estimate of the number of digestible food units. The price per ton divided by this final figure will then give the price per unit for comparison with the standard foods given in the lists printed in these notes. The nutritive ratio should also be calculated by multiplying the percentage of fat by 2 $\frac{1}{2}$, adding the percentage of carbohydrates, and dividing by the

* In this *Journal* for March, p. 1118, it was suggested that at present prices a more extensive use might be made of sharps and middlings. Since then a preliminary trial of sharps has been made with fattening steers. The figures are not yet ready for publication, but they seem to indicate that sharps should not be used extensively for fattening cattle until further trials have been made.

† This *Journal*, May, 1915, p. 148.

percentage of protein. This gives an estimate of the proportion of flesh-forming protein to heat- and fat-forming constituents, and assists in deciding if the food is suitable for the purpose for which it is required. If sellers of these articles will send to the Director of the Animal Nutrition Institute, School of Agriculture, Cambridge, guaranteed analyses and prices of their standard brands of foods, it may be possible to consider them for the next notes published.

Below are given suggestions for rations in June :—

For Horses at Farm Work.—The same ration as that given last month may be used, namely :—

- 4 lb. Wheat sharps,
- 2 „ Crushed maize, and
- 1 „ Bean meal.

This should be mixed with damp chaff. The usual ration of long hay or green fodder should be used. Where horses are not given hay or green-stuff, but have to graze the dry benty grass which will result if this dry weather continues, it may be advisable to add 1 or 2 lb. of linseed cake to the ration of dry food as a laxative. It is necessary to increase by 2 or 3 lb. the whole concentrated ration for very large or free working horses.

For Cattle finishing for Beef on Roots or Green-stuff.—Last month's ration cannot be improved. If, however, the green-stuff is vetches or lucerne, both of which contain much protein, half the linseed cake may be replaced by crushed maize, or maize meal may be given in place of bean meal.

For Cattle finishing for Beef on Grass.—If the drought continues, the grass will be dry and benty, with no tendency to produce scouring. In these circumstances linseed cake should be used, as at present prices it is cheaper than cotton cake. Where the grasses are short and the pasture is closely cropped, so that the animals chiefly get small clovers which are rich in protein, broken or crushed maize would be more suitable than linseed or other cake.

For Cows at Grass.—If the grass is making plenty of growth, cake may be stopped. If the grass is short and dry owing to continued drought, linseed cake should be used in place of cotton cake, as it is now cheaper per food unit. Coconut cake is apt to go rancid in hot weather, and to become distasteful to stock.

For Calves for Baby Beef at Grass.—The same ration as last month.

For Heifer Calves and Store Steers at Grass.—The same ration as last month.

For Store Lambs at Grass, or on Rape or Cabbages.— $\frac{1}{4}$ lb. linseed cake and $\frac{1}{4}$ lb. dried brewers' grains. If the lambs are on vetches or crimson clover or clover aftermath— $\frac{1}{8}$ lb. maize.

For Lambs Fattening on Grass.— $\frac{1}{4}$ lb. linseed cake, and $\frac{1}{8}$ lb. maize.

For Pigs of all Kinds.—Rations as in last month's notes.

Up to the present time very little has been done by large commercial growers in the crossing of well known types and varieties of small fruit. Occasionally a sport or stray seedling has been observed, and, by growing on, a variety of considerable merit has sometimes resulted. This class of work has been left almost exclusively to a few large firms who have gained a reputation as raisers of stocks of fruit bushes and trees.

Experiments in Crossing Black Currants.—Black currants are cultivated very successfully by Colonel Petre on his estate at Westwick, Worstead, Norfolk. Mr. George Davison, who is in charge of the plantations, is a hybridiser well known to horticulturists. His chief successes, up to the present, have been with herbaceous plants, notably Montbretias, but as a fruit grower he is almost equally well known. His long experience in handling large areas of black currants enables Mr. Davison at once to detect the defects of existing varieties and to decide on the most likely methods of improvement. With the object of securing satisfactory new varieties, crosses have been made, and an extensive area has been laid down to seedling black currants.

The main objects of the crosses are the production of:—

1. A late fruiting variety of black currant, so as to prolong the season.
2. A variety with a comparatively hard skin which will stand transport without injury.
3. Late blossoming varieties of merit.
4. Varieties not liable to "run," *i.e.*, to lose their fruit.
5. Varieties resistant to the attacks of the Black Currant Mite (*Eriophyes ribis*).

The varieties from which the actual crosses have been made are Westwick Champion, Carter's Champion, Boskoop, Victoria, and Baldwin, while one or two other varieties have been introduced which it is unnecessary to mention.

The product of each cross has been carefully raised, every seedling being grown and kept separate from the other crosses, and at the end of two years the seedlings have been planted out in their permanent fruiting positions.

Six acres of the best fruit land have been devoted to the growing of the seedlings, which are planted at the rate of 1,000 to the acre. They are manured and cultivated in the same way. During the first winter (December) the young bushes are all cut hard back to within 6 in. of the ground.

The first batch of seedlings was planted out in 1913; strong young bushes have now been obtained and this year a crop of fruit may be expected.

Great differences are apparent in the bushes, the colour of the wood, the foliage, and the habit of growth all varying.

Care has been taken to ensure that the exact parentage of every promising cross can be traced. Spare cuttings were saved when the bushes were headed back, and these were inserted in rows and carefully numbered to correspond with the plant in the fruiting brake. Thus whenever a seedling of promise is observed a considerable stock is already available for purposes of propagation.

Pears.—Commercial pear growing is also most successfully carried out at Westwick. Doyenné du Comice, which is not surpassed for quality, is grown exceptionally well, and although cultivated on a commercial scale the fruit is as large as in trees grown in private gardens.

The Doyennés are very successfully mated with Glout Marceau, pollination not being left to chance. Every year as soon as a fair amount of blossom has opened on both varieties, boys are employed to secure cross-pollination; for several hours each day they gently brush the blossoms with rabbits' tails fixed on slender bamboo canes. In this way they liberate and carry the pollen from the one variety to the other. The results obtained over a series of years amply justify this extra attention and expense.

ABOUT a year ago the attention of the Board was directed to the fact that seeds of Clustered Clover (*Trifolium glomeratum*) were being offered from New Zealand for

Adulteration of White Clover Seed. sale in this country, and that there was a possibility of their being sold as white clover to English farmers by seed merchants, either alone or mixed with genuine white clover.

A sample of the seeds mentioned was examined at Kew, and some of the seeds were sown. The bulk proved to be clustered clover with (among others) one or two seeds of suckling clover (*T. minus*), which is never sown in this country and which is regarded on the Continent as a weed in clover samples. A further species which has been used as an adulterant in New Zealand and which may, therefore, be present in samples of white clover of New Zealand origin, is small-flowered clover (*T. parviflorum*). An account of the seed of this variety as a weed seed in white clover has already been given in this *Journal*.*

T. glomeratum is an annual clover having little or no value. Its usual habitat is by the side of the roads and along the borders of open pastures, and there is no record of its ever having been in cultivation here. The species has spread over considerable areas in New Zealand in recent years, large quantities of the seed being frequently extracted in the cleaning of rye grass and other pasture seeds. The Department of Agriculture of New Zealand have found numerous instances of the deliberate adulteration of white clover seed with the seed of clustered clover, the latter being present in quantities of from 15 to 40 per cent. of the whole sample. Such adulteration is easy, as the seed of clustered clover sufficiently resembles that of white clover to pass unnoticed in the absence of careful examination; and the fact that the addition of clustered clover seed to the average sample of white clover seed improves the colour of the latter has even been taken advantage of to secure a higher price.

The following description of the seeds of clustered clover has been given in the *New Zealand Journal of Agriculture* (Vol. IX. No. 5):—

Shape: Inclined to be heart-shaped; sides somewhat flattened, but more rounded than white clover (*T. repens*) and small-flowered clover (*T. parviflorum*).

Surface: Of comparatively uniform colour; almost the same shade as the lightest yellow seeds of *T. repens*. Each face marked slightly with a groove. The surface is decidedly dull, being finely roughened, a character which, together with its smaller size, facilitates the identification when mixed with *T. repens*, the surface of which is very smooth to slightly shining.

* For the description of white clover (*T. repens*) and small-flowered clover (*T. parviflorum*) see *Journal*, July, 1911, p. 323.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Lime Requirements of Certain Soils (*Jour. Agric. Sci.*, March, 1915; H. B. Hutchinson and K. MacLennan).—This paper deals with the lime requirements of certain soils (a) for sterilisation purposes, (b) for neutralisation purposes.

Sterilisation.—Calcium oxide (caustic lime) can produce partial sterilisation effects but not calcium carbonate (chalk, limestone, marl, etc.).

The amount of lime necessary to produce specific effects in different soils has been found to vary greatly and it is not possible to make any general recommendations. The method proposed for indicating the critical amount required is based on the determination of the amount necessary for the production of an alkaline reaction of the soil water; the amounts thus indicated agree very closely with those required for the production of typical partial sterilisation effects in the soil itself, e.g., the inhibition of protozoa and nitrifying organisms. The amount of lime thus indicated not only gives the maximum production of dry matter in the *first* crop following treatment, but also in the first four crops.

Certain physical changes also occur about the partial sterilisation point.

Neutralisation.—The method described for the determination of the lime requirements of the soil is based on the absorptive capacity of the soil for calcium carbonate, this method having the advantage that no absorption is indicated in the case of neutral soils. An application of carbonate to a soil exercises a marked effect in accelerating the process of ammonification, and, to a lesser degree, nitrification; soils showing a positive lime requirement according to the proposed method have been found to respond distinctly to the application of carbonate (a) by increased ammonia and nitrate production in laboratory experiments, and (b) by greater plant growth in pot culture and field work.

The values of calcium oxide and carbonate have been shown to be identical provided that the lime requirements for neutralisation purposes are not fully satisfied. After the neutral point is reached calcium oxide exercises its specific effect (see *sterilisation* above).

In the case of soils on the same geological formation a definite relation between soil reaction and natural flora has been traced. The occurrence of certain plants on acid soils appears to be determined by their capacity of resistance to acidity.

FIELD CROPS.

Linseed: Effect of Certain Factors on the Oil Content (*Jour. Agric. Sci.*, March, 1915; J. Vargas Eyre, M.A., Ph.D., and L. A. Fisher, M.A.).—The inference is drawn from experiments that, given the most suitable variety and an average season, linseed growing in this country is a profitable undertaking; further, that the only difference between the seed from the fibre crop and that from the

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

linseed crop is one of yield, there being little difference in oil content between the two kinds, so that, by harvesting early, the best quality fibre may be obtained without materially lessening the oil content and consequently the value of the seed, little being gained as regards oil content by allowing the seed to ripen before harvesting the crop.

Trials carried out by various agricultural colleges in England in 1913, an average season, indicated that linseed grown in England is by no means inferior in oil content to imported samples of the same varieties. As regards yield of oil per acre the varieties tested took, on the whole, the following order:—(1) Plate, (2) Steppe, (3) Moroccan, (4) Dutch. With the same variety an increase in the oil content was accompanied in practically all cases by an increase in the size of seed. No support was given to the view that repeated growth of linseed from the same stock gives rise to a seed of diminished oil content. The use of artificial manures was found to cause only a very slight variation in the oil content, the main effect produced being in respect of yields of seed and straw.

Linseed: Varieties and Cost of Growth (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Four varieties of linseed were sown after seeds on a clean sandy loam, the manuring given being 3 cwt. superphosphate and 1 cwt. sulphate of potash per acre. The rates of seeding were as follows, per acre:—Morocco 112 lb., River Plate 80 lb., Russian (Steppe) 72 lb., and Dutch 92 lb. The yields of seed, straw, and chaff were, per acre:—

—	Seed.	Straw.	Chaff.
	Cwt. lb.	Cwt. lb.	Cwt. lb.
Morocco	14 58	21 26	12 56
River Plate	16 96	21 11	7 60
Russian (Steppe)	15 96	21 11	7 54
Dutch	10 64	31 18	8 39

Some trouble was experienced in cutting and tying the Morocco and Dutch varieties owing to the shortness of the straw of the former and the length and tangled nature of the stems of the latter.

The cost of growing the crop was found to be £6 15s. 5d. per acre, the chief items being rent, &c., £1 15s., ploughing 12s., artificials £1 1s. 4d., seed 16s., weeding 6s., cutting 6s., tying 5s. (about half were hand-tied), carting and stacking 8s., and threshing £1.

Experiments with Mangolds (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—*Varieties*.—The average results over the three years 1912–14 were as follows (per acre):—Yellow Globe, 23 tons 12 cwt.; Long Red 22 tons 4 cwt.; Red Intermediate, 21 tons 6 cwt.; Sugar Mangel, 20 tons 3 cwt.; Yellow Intermediate, 20 tons 3 cwt.; Golden Tankard, 18 tons 11 cwt. In addition to its cropping powers, Sugar Mangel was shown by analyses to be of higher quality than the other varieties.

Manuring.—These experiments were carried out on three farms (one on a heavy clay soil, the other two on a light loam) during three seasons with Yellow Globe Mangolds. The average results per acre were as follows (15 tons of farmyard manure were given in all cases):—

Manure.	Yield.	Profit.
1. No artificials	t. cwt.	£ s. d.
2. 2 cwt. nitrate soda	16 1	—
3. 2 cwt. nitrate soda + 3 cwt. superphosphate ½ cwt. steamed bone flour	19 12	1 12 3
4. As on plot 3 + 3 cwt. kainit	20 17	2 1 0
5. As on plot 3 + ½ cwt. sulphate of potash + 3 cwt. salt	19 2	0 17 3
6. ½ cwt. sulphate of ammonia, + 1 cwt. nitrate of soda + 3 cwt. superphosphate + ½ cwt. sulphate of potash + 3 cwt. salt + ½ cwt. steamed bone flour	20 13	1 6 0
7. 2 cwt. nitrate of soda + 3½ cwt. basic slag + 3 cwt. kainit + ½ cwt. steamed bone flour ..	21 12	2 0 3
	19 8	0 11 9

The increases in the yield of mangolds were valued at 15s. per ton.

Manuring of Mangolds and Swedes on Poor Arable Land (Hereford Educ. Com.).—The demonstration was carried out on poor high-lying arable land, which had not yielded a paying crop for many years. The soil was clay loam, wet in places, deficient in lime and infested with weeds. Six plots, each one-sixth of an acre in extent, were laid out, three for mangolds and three for swedes. All plots received about 15 loads of dung per acre. The further treatment and the results obtained were as follows (per acre):—

Manure.	Yield.	Profit.*
<i>Mangolds:</i>	tons cwt.	£ s. d.
1. No artificials	12 19	—
2. 1 cwt. nitrate of soda, ½ cwt. sul. am., 3 cwt. super., ½ cwt. sul. pot., 3 cwt. salt ..	19 0	1 17 7
3. As on 2 + 30 cwt. cob lime	23 17	3 13 6
<i>Swedes:</i>		
1. No artificials	14 4	—
2. ½ cwt. nitrate of soda, 4 cwt. super., 2 cwt. kainit	19 6	1 6 6
3. As on 2 + 30 cwt. cob lime	23 0	2 1 6

* Increased yield of mangolds valued at 12s. per ton and of swedes at 10s. per ton.

Manuring of Mangolds (Hereford Educ. Com., Farmer's Bull. No. 9).—A mixture of ½ cwt. sulphate of ammonia, 3 cwt. superphosphate, ½ cwt. sulphate of potash and 2 cwt. salt per acre applied at seeding time with 1½ cwt. nitrate of lime applied as top dressing shortly after singling gave the largest increase of mangolds in these trials and left the greatest profit. Almost as good results were obtained with the above mixture, but using nitrate of soda (1 cwt.) as top dressing. The following table shows the various schemes tried and the results per acre (average of eight centres):—

Manure.	Yield.		Profit.*	
	tons	cwt.	£	s. d.
1. No artificials	20	11½	—	—
2. ½ cwt. sulph. amm., 3 cwt. super., ½ cwt. sulph. pot., 2 cwt. salt	30	19	18	11
3. As on 2 + 1 cwt. nitrate of soda	34	3½	2	10 3
4. As on 2 + 140 lb. nitrate of lime	34	10	2	19 6
5. 1 cwt. nitrate of soda, 62 lb. nitrolim, 3 cwt. super., ½ cwt. sulph. pot., 2 cwt. salt	32	17½	2	1 5
6. 1 cwt. nitrate of soda, ½ cwt. sulph. amm., 1½ cwt. basic slag, ½ cwt. sulph. pot., 2 cwt. salt	32	16½	2	0 2

* Increased yield of mangolds valued at 12s. per ton.

Manuring of Turnips (*Jour. Dept. of Agric. and Tech. Instr. for Ireland*, January, 1915).—The results of both the old and new series of experiments, commenced in 1901 and 1908 respectively, by the Irish Department of Agriculture, are taken to indicate:—

(1) That though good crops of turnips may be grown with dung alone, it is not economical to apply heavy dressings.

(2) That a medium dressing of dung (from 10 to 15 tons per acre, supplemented by from 4-6 cwt. per acre of superphosphate or basic slag, is better than a heavy dressing of dung alone, superphosphate and basic slag being of practically equal value as manure, but basic slag being preferable where lime is deficient or finger-and-toe prevalent.

(3) That of the three kinds of artificial manures phosphatic manures alone materially increase the yield. When a medium dressing of dung supplemented by superphosphate or basic slag is used it is doubtful whether the addition of either sulphate of ammonia or kainit or both will pay; without dung, however, a dressing of 4-6 cwt. superphosphate or basic slag, 1 cwt. sulphate of ammonia and 3 cwt. kainit per acre is recommended.

Manurial tests on peaty soils have shown that superphosphate and basic slag are of practically equal value and that satisfactory returns are obtained from artificials alone.

Manuring of Swedes (*Northants C.C., First Ann. Rept. on Field Expts., 1914*).—On a limestone brash soil the highest yield was given by a complete artificial manure, in trials both with and without farmyard manure. On a light loam none of the artificials were very effective in increasing the yield over that obtained by the application of farmyard manure alone; but growth was hindered by lack of moisture and the crop was evidently unable to make use of the extra plant food supplied.

At two further centres slag was compared with superphosphate: on a light loam very poor in lime and affected with finger-and-toe, slag, whether used alone or with kainit and sulphate of ammonia, produced a larger quantity of roots, and sounder roots than superphosphate; on a clay loam very rich in lime, superphosphate proved the better source of phosphate.

Fish manure containing 8.5 per cent. phosphate and 1.4 per cent. nitrogen was tried for swedes on a light loam; the conclusion was reached that it was a mistake to use this manure at £3 10s. per ton when a mixture containing the same amount of nitrogen and phosphate in a form probably more suitable for ordinary farm crops can be made up for less than £2 per ton.

Manuring of Swedes (*Jour. Univ. Coll. of Wales, Agric. Dept., 1914*).—

The experiments were carried out in North Cardiganshire on small plots. The soil was light, stony, dry and rather shallow. Superphosphate proved more suitable than basic slag when applied alone, but given with a medium quantity of farmyard manure there was very little difference between the two. Kainit and sulphate of ammonia were beneficial with superphosphate but not without superphosphate, thus showing the soil to be deficient in available phosphates.

Manuring of Potatoes (*Lindsey C. C. Educ. Com., Bull. No. 3, 1914-15; R. N. Dowling, N. D.A.*).—The advantage of mixing manures on the farm over buying compound manures was shown by this experiment, carried out on "Royal Kidney" potatoes on a deep alluvial loam, the plots varying from one-sixth to one-half an acre in size. To begin with, analysis demonstrated that the compound manures used were priced at about £2 to £2 10s. per ton more than they were worth. The dressings used, the yields of saleable potatoes, and the financial results were as follows (per acre):—

Manure.	Yield.	Cost of Manures.		Profit (+) or Loss (—)	
		£	s. d.	£	s. d.
1. 1 cwt. sul. am.	8 11	1	13 0	(+) 7	11 6
4 cwt. super. ...					
1 cwt. sul. pot.					
2. 1 cwt. sul. am.	8 8	1	3 0	(+) 7	13 9
4 cwt. super. ...					
3. 1½ cwt. nit. soda	8 0	1	15 0	(+) 5	12 0
4 cwt. super. ...					
1 cwt. sul. pot.					
4. No manure ...	5 18	—	—	—	—
5. "A" compound ...	6 2	1	19 0	(—) 1	3 3
6. "B" compound ...	6 9	1	19 0	(—) 1	0
7. "C" compound ...	7 1	2	0 0	(+) 2	0 0

Manuring of Potatoes (*Northants. C.C. First Ann. Rept. on Field Expts., 1914*).—The trial was carried out on a medium loam, with the variety Up-to-Date, the previous crop being wheat. The result emphasised the importance, especially in the absence of farmyard manure, of using a complete mixture of artificials for the potato crop. A profit of £6 16s. 9d. per acre was obtained from the use of 4 cwt. superphosphate, 2 cwt. sulphate of ammonia, and 1½ cwt. sulphate of potash per acre (the increased yield was valued at 50s. per ton). Omitting any one of these ingredients substantially reduced the profit.

Change of Seed Potatoes (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—Tests extending over three years showed change of seed to be of considerable importance. The same results were obtained in the three years as to order of cropping power of seed from various sources which was as follows:—(1) Sligo; (2) Perth; (3) Lincoln; (4) Saffron Walden; (5) Local (Chelmsford).

A further trial was made in 1914 to compare seed obtained direct from Scotland with Scottish seed grown one year and two years in Essex. It was found that in the case of the early, second early and majority of late varieties the seed obtained direct from Scotland produced the larger crops. In the case of Dalmeny Regent, however, seed grown one year in Essex was the superior in cropping power. The Scottish

seed grown one year in Essex was superior to that grown two years in the case of all varieties (four) for which this point was tested; earlier appeared to lose vigour more readily than the later varieties.

Cultivation Test with Potatoes (*Jour. Dept. of Agric. and Tech. Instr. for Ireland*, January, 1915).—Extensive experiments were carried out to show the advantage of sprouting the seed, manuring and spraying the crop. In one case seed was planted whole direct from the pit, and manured with 20 tons of dung, the crop being left unsprayed; in the other the seed was sprouted, 6 cwt. of artificials was given in addition to the dung and the crop was sprayed twice. The increased crop due to these improved methods was over 4 tons of saleable tubers per acre on the average of 31 centres.

Manuring of Hops (*Hop Manuring Experiments, Report for 1914, Dr. Bernard Dyer*).—The well-known experiments on the continuous manuring of hops carried out by Mr. Shrivell and Dr. Bernard Dyer at Golden Green, Hadlow, Tonbridge, have been reviewed in this *Journal* from time to time (see issue for March, 1914, p. 1104). The following table gives the results up to date:—

Plot.	Annual Manuring per Acre.	1913 Crop.	1914 Crop.	19 Years Average, 1896-1914.
A	Phosphates and potash	Cwt. 7½	Cwt. 9½	Cwt. 10½
B	Phosphates, potash, and 2 cwt. nitrate of soda	10½	14½	13½
C	Phosphates, potash, and 4 cwt. nitrate of soda	15	18½	16
D	Phosphates, potash, and 6 cwt. nitrate of soda	15	20½	15½
E	Phosphates, potash, and 8 cwt. nitrate of soda	15½	22½	17
F	Phosphates, potash, and 10 cwt. nitrate of soda	15½	21½	16½
X	Thirty loads (15 tons) London dung	14½	19½	15½

Composition of Wheat and its By-Products (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1915; *H. Hunter, B.Sc.*).—In 1908 the Department of Agriculture and Technical Instruction for Ireland commenced a series of experiments to ascertain the agricultural and milling values of Red Fife, Squarehead's Master, White Queen, and White Stand Up Wheats. The general composition of wheat grain, flour, bran, pollard and germ meal, as shown by the figures obtained is as follows (on dry matter):—

	Oil.	Albu- minoids.	Carbohy- drates.	Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Wheat grain ..	2·00	13·75	80	2·5	1·75
Flour ..	·75	12·75	86	0·0	·50
Bran ..	4·00	15·00	61	12·0	7·00▲
Pollard ..	4·50	16·00	68	5·5	4·00
Germ meal ..	7·00	22·00	62	2·7	4·20

Differences in the composition of the grain of the four wheats were shown to exist and to be the direct cause of differences in the flour and offals obtained after milling.

The composition of bran is largely dependent on the extent to which the skin of the grain is capable of being cleaned of closely adhering endosperm.

The composition of pollard is determined mainly by the amount of bran abstracted and the extent to which this is replaced by flour.

In these investigations the composition of the grain of the four varieties was unaffected by differences of soil and geographical position of the experimental centres.

There was no difference in the composition of the bran and pollard, of the two red wheats (Red Fife and Squarehead's Master) and two white wheats (White Queen and White Stand Up) dealt with.

In some cases the germ meal is not separated from the bran and pollard during milling, when, on account of its richness in oil and albuminoids the proportion in which it occurs in these two products must exert a considerable effect on their ultimate composition.

Varieties of Wheat (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Seed of a number of varieties of wheat was sown at the rate of $2\frac{1}{2}$ bushels per acre between October 17th and 22nd. The yields per acre (1) of grain in bushels, and (2) of straw in cwt., for each variety, were as follows:—Rivett's, $49\frac{3}{4}$, 52; Browick Grey Chaff, $44\frac{1}{2}$, $32\frac{1}{2}$; Snowdrop, 44, $41\frac{1}{2}$; Svalöf Extra Square Head, $41\frac{1}{2}$, $39\frac{3}{4}$; Wilhelmina, 41, $41\frac{1}{2}$; Squarehead's Master, $40\frac{1}{2}$, $40\frac{3}{4}$; White Chaff Square Head, $40\frac{1}{2}$, $36\frac{1}{2}$; Standard Red, 39, $39\frac{1}{2}$; Regenerated Squarehead's Master, $38\frac{1}{2}$, $35\frac{1}{2}$; Browick Grey Chaff, $38\frac{1}{2}$, $35\frac{1}{2}$; White Chaff Square Head, $37\frac{3}{4}$, $35\frac{3}{4}$; Champion, $37\frac{3}{4}$, $33\frac{3}{4}$; Red Chaff Square Head, $37\frac{1}{2}$, 34; New White Wheat, $35\frac{1}{2}$, $34\frac{1}{2}$; Essex Square Head, $35\frac{1}{2}$, $30\frac{1}{2}$; Victor, $33\frac{1}{2}$, $30\frac{1}{2}$; Svalöf Grenadier, $30\frac{1}{2}$, 28.

Varieties of Wheat (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Trials of varieties of wheat were carried out at 14 centres in Shropshire, Staffordshire and Warwickshire on a number of different soils. The average yields in bushels per acre in 1914 at the 14 centres were:—Svalöf Squarehead, 41.83; Wilhelmina (5 centres), 40.90; Little Joss, 37.86; Squarehead's Master, 37.49; Browick Grey Chaff, 37.36; Standard Red, 36.89; White Chaff Squarehead (9 centres), 36.03.

Rate of Seeding of Wheat (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Five rates of sowing wheat seed were tried, the plots being drilled on October 17th with the variety Squarehead's Master. The different rates of seeding per acre and the yields per acre obtained were as follows:—(1) Seed 3 bush., grain $35\frac{1}{2}$ bush., straw 43 cwt.; (2) seed $2\frac{1}{2}$ bush., grain $41\frac{1}{2}$ bush., straw $48\frac{1}{2}$ cwt.; (3) seed $2\frac{1}{2}$ bush., grain 47 bush., straw $49\frac{3}{4}$ cwt.; (4) seed $2\frac{1}{2}$ bush., grain 47 bush., straw $45\frac{1}{2}$ cwt.; (5) seed 2 bush., grain $47\frac{1}{4}$ bush., straw $47\frac{1}{4}$ cwt. The medium seedings gave better results than the thick, and the figures on the whole bear out the results obtained in 1913.

Egyptian Wheats (*Bull. Imp. Inst. January-March, 1915*).—In order to ascertain the suitability of Egyptian wheats for export to the United Kingdom, four samples stated to be representative of the wheats grown in Egypt were submitted by the Imperial Institute for examination. Of these the following three proved suitable for the British market: (1) *Hindī* wheat, similar to Muzaffarnaggan Indian

wheat, estimated value 51s. per qr. of 492 lb. (December 10th, 1914); (2) *Saidi*, a wheat of good colour, but rough, thin-skinned, starchy and lacking strength, worth about 49s. 6d. per 492 lb. (December 10th, 1914); and (3) *Beheri*, a large berried but very rough wheat, thin skinned, starchy and lacking strength, worth about 48s. per 492 lb. (December 10th, 1914). A fourth sample representing a type known as "Gawi" was found to be unsuitable.

Varieties of Barley (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Twelve varieties of barley were tested in 1914 on a heavy loam soil in good condition. The yields per acre of (1) grain in bushels, and (2) straw in cwt. were as follows:—Svalöf Gold, 59, 26½; Princess 56, 35½; Maltster, 53, 27½; Archer's Stiff Straw, 52½, 35; Standwell (Garton's) 52, 32½; Goldthorpe, 50, 28½; Burton Malting, 49½, 31½; Plumage, 49½, 34; Standwell (College seed), 48½, 35½; Svalöf Hännchen, 45½, 33½; Svalöf Swan Neck, 38½, 23; Primus, 38½, 21.

Rate of Seeding of Barley (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Barley sown at the rate of 150 lb., 168 lb., 183 lb., and 200 lb. per acre produced respectively 56½, 56½, 55 and 56½ bushels of grain and 34, 34½, 28½ and 35½ cwt. of straw per acre.

Varieties of Oats (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Twelve varieties of oats were drilled at the rate of 4½ bushels per acre on a sandy loam. The yields per acre of (1) grain in bushels, and (2) straw in cwt. were as follows:—King's New White Oat, 88½, 38; Svalöf Victory, 85½, 40½; Leader No. 1, 85, 31½; Abundance No. 1, 84½, 35½; Abundance (New Zealand), 84½, 34½; Thousand Dollar, 84, 33½; Leader No. 2, 83, 30; Garton's New Black Oat, 80, 32½; Leader, 78½, 30½; Abundance, 74½, 33; Abundance No. 2, 67½, 36½; White Horse, 61½, 26.

Rate of Seeding of Oats (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—In order to test the rate of seeding oats, 5 plots were drilled with Leader oats in varying quantities. The rates of seeding per acre and the yields per acre obtained were as follows:—(1) Seed 100 lb., grain 95 bush., straw 37 cwt.; seed 120 lb., grain 100 bush., straw 36½ cwt.; seed 160 lb., grain 101 bush., straw 38½ cwt.; seed 200 lb., grain 94 bush., straw 37½ cwt.; seed 240 lb., grain 95½ bush., straw 41½ cwt.

Manuring of Crassland for Meat and Milk (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—This test was started in 1911*. The three plots concerned, each of 3½ acres, have been annually manured per acre as follows:—Plot I., 2½ cwt. of superphosphate, costing 8s. 4d. per acre; Plot II., 2½ cwt. of superphosphate and ½ cwt. of sulphate of potash, costing 13s. 11d. per acre; Plot III., no manure.

In 1914 the dressings were applied on February 18th, and on May 18th two dairy cows were put on each plot for twenty weeks, the surplus herbage being consumed by yearlings.

The yield and total value of the milk obtained from the cows were as follows:—Plot I., 673 gal., £16 4s. 4d.; Plot II., 737 gal., £17 15s. 8d.; Plot III., 668 gal., £16 1s. 9d.

The value of the keep of the yearlings was reckoned at 1s. 3d. per week, and on this basis the grazing on the various plots was worth:—Plot I., £2 4s. 5d.; Plot II., £2 7s. 6d.; Plot III., 17s. 6d. The total

* The results for 1912 and 1913 are given in this *Journal* for March, 1914, p. 1102, and July, 1914, p. 339, respectively.

increases in live weight were from Plot I., 2 cwt. 3 qr. 17 lb., from Plot II., 3 cwt. 25 lb., and from Plot III., 1 cwt. 1 qr. 10 lb.

Combining the above figures, the net returns, after deducting the cost of the manures, and ignoring the increase in weight of the yearlings, were: Plot I., £16 19s. 7d.; Plot II., £17 14s. 5d.; Plot III., £16 19s. 3d.

Manuring of Meadow Land (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Experiments were commenced in 1903 in order to determine various points in connection with the application of farmyard manure and artificials to grassland. The soil was a stiff clay loam, resting upon a bed of clay overlying the red sandstone. The manures, with the exception of the dung, were applied each year, and the plots were mown and grazed annually. The results per acre of the 12 years' manuring are given in the following table:—

Plot.	Manures applied annually.	Cost of manures for 12 yrs.	Total yield for 12 yrs.	Value of increase at 50s. per ton for 12 yrs.	Net profit for 12 yrs.
		£ s. d.	t. c. lb.	£ s. d.	£ s. d.
1	No manure	—	12 17 4	—	—
2	1½ cwt. nit. of soda; 2½ cwt. super.; ½ cwt. sulph. of pot.	13 16 6	22 15 59	24 16 3	10 19 9
3	As 2, omitting sulph. of pot.	11 11 6	21 18 94	22 14 6	11 3 0
4	As 2, omitting super.	9 11 4	15 15 58	7 6 3	2 5 1 (loss)
5	As 2, omitting nit. of soda	6 9 2	20 9 38	19 0 10	12 11 8
6	10 tons dung (1903, 1907 and 1911) ..	7 10 0	19 4 28	17 3 0	9 13 0
7	As 6, with complete artificials in intervening years ..	17 19 7	23 5 78	16 1 8	1 17 11 (loss)
8	1½ cwt. nit. of soda ..	7 7 4	15 11 66	6 16 4	0 11 0 (loss)
9	2½ cwt. super. ..	4 6 10	19 5 108	16 2 6	11 15 8
10	½ cwt. sulph. of pot.	2 4 0	13 16 0	2 7 6	0 3 6 (loss)

The yield and value of the produce is stated only for that portion of the crop which was removed as hay.

Artificials were not profitable, when combined with an application of farmyard manure once in four years, though they considerably increased the yield. The residual effect of the dung on Plot 6 was clearly defined during each period of 3 years when no manure was applied. The leading requirement of the herbage on this soil was clearly shown to be phosphate.

In 1911 each plot was divided into two equal portions and 10 cwt. of lime per acre was applied to one-half, the other receiving no lime. The effect was most marked on those plots receiving superphosphate while with nitrate of soda and sulphate of potash the effect was negligible.

A further test was carried out to compare the effect of potassic superphosphate, superphosphate and kainit on a stiff clay loam soil. The results per acre were as follows:—

Plot.	Manures applied.	Cost in 1914.	Average yield, 1911-14.
		s. d.	cwt. lb.
1	365 lb. super. and 81 lb. kainit.	12 11	23 98
2	4 cwt. potassic super.	16 0	23 19
3	365 lb. super.	10 10	22 84
4	No manure	—	21 3
5	365 lb. super. and 70 lb. nit. of lime	17 1	24 98

Liming of Grass Land (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—The field used was an old pasture, grazed for many years by cattle receiving a good allowance of cake. Lump lime applied for 3 years at the rate of $18\frac{1}{2}$ cwt. per acre per annum caused an average annual increase in hay of $7\frac{1}{4}$ cwt. at a cost of $8\frac{1}{2}d.$ per cwt.; ground lime at the rate of 15 cwt. per acre gave an average increase of $5\frac{1}{2}$ cwt. at a cost of $11\frac{1}{4}d.$ per cwt.; and ground limestone at the rate of $22\frac{1}{2}$ cwt. per acre caused an average gain of $4\frac{1}{4}$ cwt. at a cost of $1s. 1\frac{1}{2}d.$ per cwt.

Manuring of Meadow Hay (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—Four plots were taken. Plot I. was unmanured; Plot II. received 5 cwt. of steamed bones in 1912; Plot III. received 5 cwt. of superphosphate in 1912 and 1913; Plot IV. received $2\frac{1}{2}$ cwt. of steamed bones in 1912 and 1913. No manures were applied in 1914. The average annual yields for the 3 years 1912 to 1914 were: Plot I., 26 cwt. 98 lb.; Plot II., 29 cwt. 103 lb.; Plot III., 31 cwt. 33 lb.; Plot IV., 28 cwt. 83 lb.

Tobacco Growing in Ireland (*Jour. Dept. Agric. and Tech. Instr. for Ireland, April, 1915*).—These experiments were last summarised in this *Journal* for April, 1914, p. 58. The following table shows the results obtained in 1913:—

—	Pipe (average of 6 centres).	Pipe and Cigarette (one centre).
Average yield per acre in lb.	916	1,048
Cost of production, per lb.	$8\cdot4d.$	$6\cdot1d.$
Amount received, per lb.	$5\cdot0d.$	$6\cdot3d.$
	£ s. d.	£ s. d.
Cost of production, per acre	32 1 4	26 11 0
Amount received, per acre	19 0 5	27 12 2

Rotation Experiments (*E. Suffolk County Educ. Com. Rept. on Field Expts., Circ. 15, 1915*).—A rotation consisting of (1) roots, (2) barley, (3) beans, peas or clover, and (4) wheat, has been tested for 15 years, the land being arranged in four sections so that each crop of the rotation is grown every year. The same schemes of manuring have been carried out with each crop each year. Particulars of the results for each crop for each combination of manures over the whole 15 years are given in the Report.

The greatest net profit has been obtained from the use of a dressing of 2 cwt. superphosphate and 2 cwt. nitrate of soda to each crop each year; the net gain was practically $\text{£}1$ per acre per annum over the 15

years. The net profits from (a) 2 cwt. superphosphate alone and (b) 2 cwt. superphosphate combined with 2 cwt. nitrate of soda and 1 cwt. muriate of potash were not very much inferior. Farmyard manure at the rate of 6 tons per annum gave a net gain per annum of 16s. per acre. Dressings of 4 cwt. bone meal and of 2 cwt. superphosphate and 1 cwt. muriate of potash also gave profits. Nitrate of soda and muriate of potash, either alone or in combination, resulted in losses.

The above four-course rotation has been carried out on another field for five years, but the manuring adopted has varied with the crop. In this experiment comparatively good yields of corn have been obtained from the plot receiving no manure throughout the rotation. Of the various combinations tried, that giving the largest profit was 10 tons dung and 1 cwt. nitrate of soda to wheat, 1 cwt. nitrate of soda to barley, and 1 cwt. nitrate of soda and 5 cwt. superphosphate to roots; as nearly as large a profit was obtained when the nitrate of soda was omitted from the wheat and root dressings. Where, however, the dressing given to the whole rotation has been 10 tons dung, 1 cwt. nitrate of soda and 5 cwt. superphosphate it has proved better to give the dung to the roots and the artificials to the wheat, than *vice versa*.

Varieties of Lucerne (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—The plots were sown on May 11th and the amount of green fodder cut on September 4th was: Chinese lucerne, 6 tons 3½ cwt.; Provence lucerne, 4 tons 6½ cwt.; Turkestan lucerne, 3 tons, 14 cwt. per acre. In 1912, Chinese lucerne yielded 8 tons 1 cwt. and Provence lucerne 6 tons 4 cwt. of green fodder per acre.

Growth of Millet and Sorghum (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—Millet (*Sorghum vulgare*) was drilled on May 14th at the rate of 20 lb. per acre in rows 7 in. apart; the crop reached 7 ft. in height and remained erect. It yielded 22½ tons of green fodder per acre when cut on August 17th. The crop is useful as giving an early supply of green fodder in dry seasons; the seed costs about 3d. per lb.

A small plot of *Sorghum saccharatum* sown on May 14th produced 25 tons 6 cwt. of green fodder per acre.

Doura (yellow branching) and white Kaffir corn, plants similar to sorghum and millet, produced 19 tons 3 cwt. and 23 tons 9 cwt. per acre respectively of green fodder.

Growth of Maize (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—*Varieties*.—The seed was ploughed in on May 26th in rows 20 in. apart, at the rate of 2 bushels per acre; the land received, in addition to 15 loads of farmyard manure, ¾ cwt. sulphate of ammonia, 3 cwt. superphosphate and ¾ cwt. sulphate of potash, while ½ cwt. nitrate of soda was given as a top dressing. The yield of green fodder per acre was as follows:—Improved Leaming, 29 tons 4 cwt.; Eureka, 27 tons 10 cwt.; White Horse Tooth, 27 tons 1 cwt.; Improved Horse Tooth, 26 tons 19 cwt.; Wood's Northern Dent, 26 tons 10 cwt.; White Cap Yellow Dent, 23 tons 15 cwt.; Longfellow, 23 tons 13 cwt.; Giant Caragua, 23 tons 7 cwt.; Rural Thoroughbred White Flint, 22 tons 10 cwt.; Evergreen Sweet Fodder, 16 tons 5 cwt. Similar tests were carried out in 1912 and 1913, and the results of the three years' experiments have shown the American varieties, Improved Leaming, Eureka and Wood's Northern Dent to be heavy yielders of green fodder.

Distance between the Rows.—The greatest yield was obtained with rows 8 in. apart and the yield diminished as the distance between the

rows was increased. With the narrow distance the conditions would, however, be unfavourable to subsequent thorough cleaning and stirring of the soil, in addition to rendering necessary more seed.

Experiments with Green Crops (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—The relative cropping powers and the effect of the time of sowing on the yield were determined, with the following results (per acre):—Kohl Rabi (sown on April 16th), 24 tons 19½ cwt., (sown on April 29th) 21 tons 17½ cwt.; Marrow-stem Kale, 24 tons 16½ cwt., 20 tons 12½ cwt.; Cabbages, 22 tons 4 cwt., 20 tons 11 cwt.; Swedes, 18 tons 10½ cwt., 11 tons 7½ cwt. Marrow-stem Kale is the result of a cross between Thousand-headed Kale and Kohl Rabi; stock eat the stem with avidity. The larger yields resulting from the earlier sowing are attributed to dry weather supervening between the two sowing dates.

Varieties of Picking Peas (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—The peas were sown on April 4th and picked in the first and second weeks in July. The following were the yields of pods (in bushels per acre):—Essex Star 374, Telegraph 345, Gradus 321, Pilot 302.

LIVE STOCK, FEEDING AND DAIRYING.

Conformation of Cows and Milk Yield.—Recent Continental research has rather tended to throw doubt on the system of judging dairy cows by various "points" of conformation (*e.g.*, see this *Journal*, January, 1914, p. 906). The case for conformation, however, is urged in an article in the *Jahrbuch für wissenschaftliche und praktische Tierzucht*, for 1914, by the director of animal breeding at Königsberg. The reliance placed on conformation by practical men is alluded to, and attention is drawn to the fact that milk "points" develop in the course of lactation. This is the case with udder, milk veins, skin and hair. It is urged that investigators have failed to take sufficiently into consideration the effect of lactation, age, feeding and care of cows.

This investigator therefore carried out an enquiry with cows of one and the same herd and only with animals of four years old, with records extending over three years and with normal lactation. The animals were examined for "points" in May and November and the average of the two awards taken. The animals were then divided into three classes according to "points." Those in class 1 gave 120 gals. more milk per cow per annum than those in class 2, and those in class 2 116 gals. more than those in class 3.

Fluctuations in the Weight of Newly-Born Animals (*Jahrbuch für wissenschaftliche und praktische Tierzucht, 1914*).—While it is a well-known fact that there is a decrease in the weight of children in the first few days subsequent to birth, but little has been done towards investigating whether this phenomenon holds good for animals; hence these experiments at the Royal Veterinary High School at Dresden with cattle, sheep, goats, and swine.

Of 25 calves, 80 per cent lost weight in the first few hours after birth, the remaining 20 per cent either retaining their original weight or even increasing. The loss in weight averaged 4 per cent, and the net loss in weight reckoned on all calves averaged 2 per cent. The period over which the loss in weight extended averaged 21.8 hours; increase in weight began on the average after 38.2 hours, or reckoned

on *all* calves, after 30.5 hours. The weight at birth was regained on the average after 61½ hours, or reckoned on *all* calves after 48.9 hours.

Of 12 *lambs* and 10 *kids*, 60 per cent. lost weight; the loss averaged 4.1 per cent., lasted on the average over 11.6 hours, increase in weight began again after an average of 23.4 hours, and the initial weight was reached again after 40 hours on the average (or after 23.6 hours reckoned on *all* animals).

Newly-born *pigs* showed, in the majority of cases (85 per cent.) increase from birth onwards. With a small minority a decrease in weight began soon after birth, and averaged 3.6 per cent. of the weight, lasted 7 hours and the initial weight was regained after 15.6 hours.

Effect of Condensing and Drying on the Bacterial Content of Milk (*Repts. to Local Govt. Bd. on Public Health and Medical Subjects, Food Repts. No. 21; Dr. S. Delépine*).—Three methods of preservation of milk as practised at four factories in England were investigated, viz. :—(1) manufacture of sweetened condensed milk, (2) drying of milk over heated revolving cylinders, (3) drying by spraying the milk into a current of hot air.

The total number of bacteria present in mixed cows' milk, such as is usually supplied to town consumers, was found to be considerably reduced by treatment according to each of the three methods, the reduction being greatest with (1) and least with (3).

In each of the three methods there was a stage at which the reduction in the total number of bacteria was much greater than that observed in the finished article ready for sale, the increase observed during the final stage being due to recontamination.

At none of the stages of preparation was the milk ever found completely sterile, some saprophytic and pathogenic bacteria being left unharmed; of the latter, tubercle bacilli survived pasteurisation in method (1) and the treatment in method (2) and, therefore, that in method (3). The tuberculosis produced in guinea pigs by these heated bacilli was, however, "latent" or "occult" for some four weeks, and young rabbits fed with milk containing these modified bacilli did not contract tuberculosis.

The Freezing Point of Milk as a Test for Added Water (*Repts. to Local Govt. Bd. on Public Health and Medical Subjects. Food Repts., No. 22; Dr. G. W. Monier-Williams*).—Continental chemists have called attention to the fact that the freezing point of milk varies within comparatively narrow limits. The addition of water to the milk has the effect of raising the freezing point in proportion to the quantity of water added. It is claimed that the value observed for the freezing point affords a more certain and accurate indication of the presence and relative amount of added water in milk than can be obtained from the results of chemical analysis alone.

In this investigation the average freezing point of 141 samples of genuine milk was found to be -0.5345°C. , the values ranging from -0.558°C. to -0.514°C. It is concluded that the freezing point of milk appears to be the most constant of any of the properties exhibited by genuine milk. Although unaffected by the removal of fat from, or the addition of separated milk to, genuine milk, it is raised by the addition of water to the milk.

The method may, in certain circumstances, be applied with advantage, as a confirmatory test, to the detection of added water and

to the approximate estimation of the amount present. Owing, however, to the experimental difficulties involved in obtaining reliable results, it is somewhat doubtful whether the method is capable of general application for purposes of milk control.

Ability of Colon Bacilli to Survive Pasteurisation (*Jour. Agric. Research*, February, 1915).—The thermal death point of cultures of colon bacilli isolated from cow faeces, milk and cream, human faeces, flies and cheese showed considerable variation when the cultures were heated in milk for 30 minutes under conditions similar to pasteurisation. At 60° C. 55 per cent. survived, while at 62·8° C. (the usual pasteurising temperature) only 7 per cent. survived; thus the raising of the temperature by the small amount of 2·8° C. was sufficient to kill 87 per cent. of the colon bacilli surviving the lower temperature. The ability of the colon bacilli to survive 62·8° C. was due to the survival of a few cells; when the pasteurised milk is held under temperate conditions which might be met with during storage and delivery of milk these surviving bacilli would be able to develop rapidly.

Only one culture of colon bacilli was not destroyed at 65·6° C. on the first heating, but in repeated experiments it was always destroyed, so that from these results it is not to be expected that any colon bacilli will survive 65·6° C. It is stated, however, that a study of more cultures might reveal strains of colon bacilli that are able to survive this and even higher temperatures.

Removal of Onion Flavour from Milk (*U.S. Dept. of Agric., Farmers' Bull. No. 608*).—When cows eat wild onion within four hours before milking their milk takes on a disagreeable odour and flavour. A process for removing this onion flavour from the milk is described; it consists in blowing air through milk heated to at least 145° F., for from 30 to 60 minutes. A slightly longer blowing period is required in the case of cream.

The Feeding Value of Flax Shives (*Mass. Agric. Expt. Sta., Bull. No. 158*).—Flax shives, sometimes incorrectly called flax bran, consist of ground refuse stalks and pods of the flax plant. They are sometimes used as a component of stock and molasses feed, and have been found on sale in Massachusetts as a substitute for wheat bran. They have the appearance of finely ground hay. Analyses of two samples showed the composition to vary widely; the results, together with the digestibility coefficients obtained in trials with sheep, were as follows:—

	Analyses.		Digestibility Coefficients.	
	Sample No. 1.	Sample No. 2.	Sheep No. 1.	Sheep No. 2.
	Per cent.	Per cent.	Per cent.	Per cent.
Water	6·8	10·0	—	—
Dry matter	93·2	90·0	42·94	47·82
Ash	12·1	5·0	21·86	23·69
Protein	6·1	14·9	79·98	82·08
Fibre	45·2	32·3	22·00	29·58
Carbohydrates	27·7	34·9	41·27	45·6
Fat	2·1	2·9	92·26	9·09

It would seem, therefore, that flax shives have a high fibre content and a small amount of protein, and their total digestibility is about 45 per cent. as compared with 66 per cent. for wheat bran.

Manioc Meal, Ground Nut Meal and Maize Gluten Feed for Dairy Cows (*Ann. de la Science Agron.*, July-December, 1914).—The addition of 4 lb. of good quality maize gluten feed to the basal ration of dairy cows was compared with 4 lb. of a mixture of manioc meal and ground nut meal in the proportion of 3 : 2. This mixture was found to be at least equal to the maize gluten feed and to result in a gain of 3s. 4d. per 220 lb. of concentrated food fed owing to the cheaper prices of ground nut meal and manioc meal as compared with maize gluten feed.

PLANT DISEASES.

Stalk or Sclerotium Disease of Potatoes (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1915; *G. H. Pethybridge, Ph.D., B.Sc.*).—In 1914 the number of plants affected by this disease was found on the whole to diminish with increasing lateness in planting, the reduction being remarkably striking in the plots planted from the middle of May onwards. With early planted potatoes the period at which the rate of infection was greatest was from the first week in July to the first week in August. When, however, planting is delayed to a very late date diminished yields result; in 1914 the maximum crop on old land was obtained by planting at the beginning of April and on new land a month later.

No case of disease was found in plots of Champion II., Clifden Seedling and Summit.

Potato Blight (*Jour. Dept. of Agric. and Tech. Instr. for Ireland*, April, 1915; *G. H. Pethybridge, Ph.D., B.Sc.*).—In 1914 Bordeaux mixture proved superior to Bordeaux paste prepared by combining commercially pure, 99 per cent. sulphate of copper and hydrated, selected lime, in addition to which the cost of the paste was about twice that of the Bordeaux mixture.

Bordeaux and Burgundy mixtures prepared from a 1 per cent. solution of copper sulphate in 1914 produced both a greater total yield of potatoes and a slightly greater yield of healthy tubers as compared with mixtures prepared from a 2 per cent. solution of copper sulphate. The work of past seasons has shown that the differences due to the use of spraying mixtures of the two strengths named are not very great one way or the other.

A Burgundy mixture prepared by precipitating copper sulphate with commercial potassium carbonate instead of the usual sodium carbonate was tested in order to ascertain the effect of combining with the mixture used against the blight a substance which would, if absorbed, be of benefit to the potato plant. The results in 1914 showed a very slight advantage in favour of this potash mixture over the ordinary soda mixture; the advantage gained would not justify a change from the use of soda to that of the more expensive potash in preparing Burgundy mixture.

Four varieties of potatoes which have a good reputation in England as being resistant to blight, viz., Langworthy, Golden Wonder, Peacemaker and What's Wanted failed to exhibit this character in Irish trials in 1914 at least as regards foliage and stalks, and the yields were small. The varieties Champion II. and Clifden Seedling proved very highly resistant, and Shamrock and Northern Invincible highly resistant to blight.

The result, so far, of planting blighted tubers in the open ground at the ordinary depth common in practice has been that they give rise either to complete "misses" or to healthy plants.

Dusting v. Spraying for Potato Blight (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1915; *G. H. Pethybridge, Ph.D., B.Sc.*).—The efficacy of dusting powder was compared with that of liquid sprays. Three powders were tested: one was composed of fine particles of copper sulphate and dry sodium carbonate (soda) intimately mixed, the second was the dried precipitate formed by treating copper sulphate solution with milk of lime, and the third ("copper oxide hydrate") was stated to be a by-product in the manufacture of copper. The liquid sprays tested were Bordeaux and Burgundy mixtures at the rate of 100 galls. per acre for the first spraying and 120 galls. for subsequent sprayings. The plots were duplicated, one lot being sprayed or dusted three times, and the other four times.

Compared with Burgundy mixture the first of the above powders led to a loss in total crop, a diminished yield of healthy tubers and an increase in the percentage weight of blighted tubers. Compared with Bordeaux mixture the second and third powders were much less effective in keeping the foliage free from blight, although increased total yields were obtained where the two powders were used, so that there was very little difference in the yield of healthy tubers from the three methods of treatment.

Brown Scab of Potatoes (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1915; *G. H. Pethybridge, Ph.D., B.Sc.*).—From the experiment described there is practically no doubt that the ordinary or brown scab of potatoes is due to an organism which can be killed by heat; and that mechanical irritation does not cause this scab.

Dusting v. Spraying of Apples (*Cornell Univ. Agric. Expt. Sta., Bull. 340*).—On account of the difficulty experienced in effectively spraying large orchards in the short time usually available attempts have often been made to replace spraying by dusting, the latter process being simpler and more quickly carried out. The results from dusting have usually been inferior, perhaps owing to the fact that copper preparations have been used.

These experiments were therefore carried out with powdered sulphur preparations against apple scab with results sufficient to warrant further trials. Lead arsenate in powdered form was more effective than in the spray form against the common insects of the orchard. The costs of dusting were greater than those of spraying but the process was much quicker.

NOTES ON AGRICULTURAL CO-OPERATION.

Distributive and Productive Societies.—At the end of 1913 there were 906 registered co-operative societies engaged in agricultural production and distribution in the United Kingdom.

Co-operation in Agriculture in 1913.* Of these 833 were societies engaged wholly in agricultural operations, 465 being engaged in the distribution of seeds, manures, implements, &c., and 368 mainly in the production of butter. The 833 societies had an aggregate

* *Board of Trade Labour Gazette*, April and May, 1915.

membership of 112,146, or an increase of 4·4 per cent. over the previous year and of 85 per cent. over 1903.

The total capital—share, loan, and reserve—amounted to £1,031,397, or an increase of 12·9 per cent. over 1912, and of 197·1 per cent. over 1903. The aggregate sales of these 833 societies amounted to £6,070,260, an increase of 9·2 per cent. over 1912, and of 256 per cent. over 1903, while the profit amounted to £39,923, a decrease of £11,294 on 1912 and an increase of £33,090 on 1903. They employed 3,295 persons, and paid £162,673 in wages, as compared with 3,071 persons and £146,669 in wages in 1912.

In addition to the 833 societies mentioned above, there were 73 industrial co-operative societies having farming and dairying departments. These departments employed 699 persons, paid £38,616 in wages during 1913, and had sales amounting in that year to £307,015.

The following Table shows, for England and Wales, Scotland and Ireland respectively, the sales of all the 906 distributing and productive societies and departments in 1913:—

	Agricultural Distributive Societies.	Agricultural Productive Societies and Departments.	Total.	
			Amount.	Per-centage.
	£	£	£	
England and Wales ..	1,822,050	378,322	2,200,372	34·5
Scotland	417,742	285,988	703,730	11·0
Ireland	694,841	2,778,332	3,473,173	54·5
UNITED KINGDOM	2,934,633	3,442,642	6,377,275	100·0

The great predominance of the Irish societies in agricultural production is the outstanding feature of this Table, nearly 81 per cent. of the sales of productive societies and departments being in that country. In agricultural distribution the societies in England and Wales predominate with over 62 per cent. of the total sales.

Distribution.—The following Table shows for the years 1903–13 the sales of agricultural distributive societies in England and Wales, Scotland and Ireland respectively:—

Year.	England and Wales.		Scotland.		Ireland.	
	No. of Societies.	Sales.	No. of Societies.	Sales.	No. of Societies.	Sales.
		£		£		£
1903 ..	48	87,970	2	42,760	136	393,542
1904 ..	65	146,197	2	44,850	135	372,080
1905 ..	82	214,292	5	46,610	150	371,273
1906 ..	111	387,775	8	51,511	161	420,223
1907 ..	121	572,735	12	80,338	163	484,771
1908 ..	131	751,445	19	99,530	157	469,556
1909 ..	145	885,683	31	227,141	160	491,034
1910 ..	165	1,030,515	43	291,838	168	521,193
1911 ..	217	1,325,547	55	335,470	159	525,580
1912 ..	228	1,623,805	69	307,273	153	641,239
1913 ..	242	1,822,050	73	417,742	150	694,841

In 1903 the sales in Ireland were about three times those of England and Wales and Scotland combined, but the growth in Great Britain has since been so rapid that in 1913 the sales there amounted to more than three times those in Ireland. Compared with 1912, the total sales in 1913 showed an increase in England and Wales of 12·2 per cent., in Scotland of 13·7 per cent., and in Ireland of 8·4 per cent.

Production.—The following Table gives the number of societies, with the amount of their sales and transfers, engaged in productive operations during the years 1903-1913 :

Year.	Special Farming and Dairying Societies.		Farming and Dairying Departments of Wholesale and Retail Industrial Distributive Societies.		Total Agricultural Production by all Classes of Societies.	
	No. of Societies.	Sales.	No. of Societies.	Sales and Transfers.*	No. of Societies.	Sales and Transfers.*
		£		£		£
1903 ..	225	1,181,056	51	427,594	276	1,608,650
1904 ..	256	1,232,668	60	401,383	316	1,634,051
1905 ..	260	1,372,552	56	402,639	316	1,775,191
1906 ..	272	1,683,120	61	473,258	333	2,156,378
1907 ..	287	1,829,279	64	477,379	351	2,306,658
1908 ..	303	1,969,582	69	494,889	372	2,464,471
1909 ..	318	2,044,917	71	497,997	389	2,542,884
1910 ..	336	2,255,947	71	435,568	407	2,690,615
1911 ..	338	2,387,042	72	330,267	410	2,717,909
1912 ..	352	2,925,432	76	301,069	428	3,226,501
1913 ..	368	3,135,627	73	307,015	441	3,442,642

* The goods produced by the productive departments of Industrial Co-operative Societies are usually not sold direct, but are transferred to the distributive departments.

The total sales in 1913 were £3,442,642, an increase over those of 1912 of 6·7 per cent. The sales of the special farming and dairying societies increased 165·5 per cent., while the agricultural departments of industrial societies decreased 28·2 per cent. between 1903 and 1913.

Of the total production in 1913, 11 per cent. was in England and Wales, 8·3 per cent. in Scotland, and 80·7 per cent. in Ireland.

Profit-sharing.—The returns made show that of the 465 agricultural distributive societies 46, employing 262 persons and paying £14,538 in wages, paid bonuses to their employees amounting to £650, which was equal to 4·5 per cent. upon the wages of the participants.

Of the 368 agricultural productive societies 67, employing 432 persons and paying £19,225 in wages, paid bonuses to their employees amounting to a total of £1,042, or 5·4 per cent., upon the wages of the participants.

Of the 73 departments of industrial societies 13, employing 181 persons and paying wages amounting to £11,459, paid bonuses to their employees amounting to a total of £352, or about 3 per cent., upon wages; of this total £252, or about 72 per cent., was accounted for by the farming department of the Scottish Co-operative Wholesale Society.

Cattle and Pig Insurance Societies.—In addition to the co-operative societies engaged in agricultural production and distribution in 1913, there were in England and Wales 62 registered societies for the mutual insurance of the pigs and cattle belonging to their members. There was also one society in Guernsey.

The following Table shows the progress of these societies during the five years 1909–1913 :—

	1909.	1910.	1911.	1912.	1913.
Number of Societies making Returns	57	58	58	61	63
Total membership ..	3,574	3,625	3,600	3,596	3,531
Receipts :—					
Contributions	£ 1,761	£ 1,835	£ 1,809	£ 1,822	£ 1,883
Other receipts	495	507	153	472	491
Total Receipts ..	2,256	2,342	2,262	2,294	2,374
Expenditure :—					
Benefits to Members ..	1,908	1,751	1,921	1,815	1,784
Working expenses ..	387	388	257	290	285
Total Expenditure ..	2,295	2,139	2,181	2,105	2,069
Total funds at end of year..	7,671	8,105	8,112	8,344	8,610

Registered pig and cattle societies, however, constituted only a small minority of the total number of such societies. There were about 1,200 unregistered pig and cattle clubs in England alone, of which some 400 were in Lincolnshire; but complete information as to the financial operations of these societies is not available.

Co-operative Credit Associations.—At the end of 1913 there were at work in the United Kingdom 223 co-operative credit associations—17 urban and 206 rural—with an aggregate membership of 22,671, as compared with 154 associations and 10,509 members in 1903. The number of societies has thus increased by nearly 45 per cent., and the members more than doubled during the ten years.

Of the 223 associations 49, with 4,147 members, were in England; one, with 353, was in Scotland; and 173, with 18,171 members, were in Ireland.

All the Irish associations were rural, and the single Scottish association was urban. In England, 16 were urban and 33 rural.

The amount of loans advanced by these associations in 1913 was £72,368, and the amount repaid (including interest) was £81,307, compared with £33,753 advanced and £27,194 repaid in 1903. The total capital in 1913 was £168,700, and the amount owing by borrowers was £113,693.

The associations are usually managed by unpaid officials, and the working expenses are therefore small. The total working expenses (including interest on capital) of the whole of the 223 associations were only £7,586 in 1913. The aggregate net profit made by all the societies was £896.

The following Table gives details for the year 1913 of urban and rural societies in England and Wales, Scotland, and Ireland respectively :—

	Urban.		Rural.		Totals.
	England and Wales.	Scotland.	England and Wales.	Ireland.	
Number of Societies	16	1	33	173	223
Membership ..	3,388	353	759	18,171	22,671
Capital :—	£	£	£	£	£
Shares	8,083	5,533	3	—	13,619
Loans	22,296	60,051	2,428	61,350	140,125
Reserves	1,229	2,490	350	4,887	8,956
Loans advanced ..	10,590	1,016	1,606	59,096	72,308
„ repaid (including interest) ..	11,975	4,899	1,740	62,693	81,307
Owing by borrowers	11,277	38,357	2,251	61,808	113,693
Working expenses (including interest paid on capital) ..	2 086	2,393	102	3,005	7,586
Net profit on year ..	228	140	41	487	896

VARIOUS provisions with regard to the granting of loans to agriculturists in British Columbia are made in the "Agricultural Act, 1915" of that province.

Agricultural Credit in British Columbia. An "Agricultural Credit Commission" is set up with power to purchase, let, and deal in real and personal property and to grant

loans on the security of mortgages for the following purposes :—

- (1) The acquisition of land for agricultural purposes,
- (2) Adaptation of agricultural land, or
- (3) Any purpose calculated to increase the productiveness of agricultural land.

The loans are to be made on the basis of valuation by a "Department of Appraisal and Valuation," which is to be established by the Agricultural Credit Commission; and the mortgages accepted as security must be first mortgages on surveyed agricultural land in the province.

In granting loans the Commission has to take the following points into consideration :—

- (1) The value of the security, as fixed by the Appraisal Department,
- (2) The ability of the borrower to make a living for himself and his family from the land after expenditure of the loan, and
- (3) Whether the loan will be of economic benefit to the borrower.

The loans made are to vary in amount between £50 and £2,000 (approximately) in the case of individuals, but the latter amount may be exceeded in special instances in the case of associations; no loan, however, is to exceed 60 per cent. of the appraised value of the security. The Commission may advance the loan to the borrower by instalments; in no case will the advance made as part of a loan for improvements exceed the proportion of the work done to the entire work.

As regards the period of repayment, loans may be (1) long-dated, (2) short-dated (*i.e.*, from three to ten years), or (3) for a single season only (*i.e.*, repayable within 12 months). The rate of interest is to be fixed from time to time on the basis of not more than 1 per cent. above the rate actually paid by the Commission on funds raised for their own purposes. Long-dated loans are repayable within 36½, 30 or 20 years, and instalments and interest are repayable half-yearly.

Additional loans may be granted up to the limit of 60 per cent. on the appraised value of the security.

The following provisions are made to meet cases of default : If the loan or interest is unpaid, or if the loan is not applied for the specified purpose, or carefully and economically expended, or not applied within a reasonable time, or if agreements are not observed, the Commission may refuse further instalments and recover advances made, without recourse to the Courts, by entering and taking possession of the security, which they may sell or lease, or place in the hands of a Receiver to manage and realise. The Commission, in transferring the lands acquired in this way, can give a good and valid title notwithstanding any encumbrance in favour of other persons.

OFFICIAL NOTICES AND CIRCULARS.

THE Board of Agriculture and Fisheries strongly urge all farmers to raise as much stock as possible during the war.

<p>Preservation of Flocks and Herds and Maintenance of Meat Supply.</p>	<p>They make the following recommendations not only for the National Welfare, but because they believe them to be for the ultimate benefit of British Agriculture.</p>
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Their advice to you is—

Do not send breeding and immature stock to the **butcher** simply because prices are attractive **now**.

Do not market half-finished animals ; it is wasteful of the country's resources and is against your own interest.

Do not kill calves,—rear them ; it is well worth it.

Do not reduce your stock ; when you cannot buy stores, buy calves.

Maintain your flocks and breed your sows ; it will pay you to do so.

THE Board of Agriculture and Fisheries desire to draw the attention of occupiers of land to the special importance under present circumstances of the prompt col-

<p>Crop and Stock Returns: Special Notice.</p>	<p>lection of the annual Crop and Stock Returns. The information furnished by these returns will be particularly valuable in connection with the economy of the</p>
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Nation's food supply during the war. The Board accordingly urge any occupier who has delayed filling up his schedule to do so immediately and to post it at once to the address shown on the forms. Farmers will serve the interests of the country by promptitude in this matter.

THE Board of Agriculture and Fisheries have awarded a Fream Memorial Prize, of the value of £7 4s. 7d., to Mr. John Wilson, New Road, Mauchline, Ayrshire, a student of the West of Scotland Agricultural College, Glasgow, who took first place in this year's examination for the National Diploma in Agriculture.

WITH a view of encouraging and assisting the breeding of light horses, the Board of Agriculture and Fisheries have been authorised by the War Office to arrange for the sale of Army Mares from time to time of Army mares which have been returned from abroad as no longer suitable for use with the Expeditionary Force, and which have been specially selected in France by the Board as of types suitable for breeding purposes.

These mares are kept under the care and observation of the Board for a month after their return from abroad, and are then sold by public auction on the express condition that they are not at any time to be exported out of the country. To secure observance of this condition the mares are branded with a distinctive mark of diamond shape (<∨).

The mares are not sold unless they have passed the mallein test for glanders to the satisfaction of the Board's Veterinary Officers, but no guarantee is given as to their age, soundness or otherwise. The mares can be examined prior to disposal at the places of sales by veterinary surgeons on behalf of intending purchasers.

Mares to be sold can be seen at the Cattle Testing Station, Pirbright, Surrey (Woking Station 5 miles, Brookwood Station 3 miles) by arrangement with the Inspector-in-Charge.

The fourth consignment of these mares, 78 in number, was sold by order of the Board as follows :—

- 12 on 2nd June at Carlisle, by Messrs. R. Harrison & Son.
- 9 on 4th June at Exeter, by Messrs. J. A. Collings & Sons.
- 12 on 4th June at Chippenham, by Messrs. Tilley, Parry & Culverwell.
- 9 on 4th June at Lichfield, by Messrs. Winterton & Sons.
- 9 on 5th June at Shrewsbury, by Messrs. Hall, Wateridge & Owen.
- 9 on 5th June at Norwich, by Messrs. Spelman.
- 9 on 5th June at Berwick-on-Tweed, by Mr. A. L. Miller.
- 9 on 8th June at Haverfordwest, Pembroke, by Messrs. Evans & Roach.

It is hoped to arrange for further sales in various parts of the country during the next few months.

The Board take this opportunity of drawing the attention of owners of mares to the fact that all Premium Stallions subsidised by the Board are travelling during the present season at the low service fee of £1.

THE American Gooseberry Mildew (Fruit) Order of 1915 of the Board of Agriculture and Fisheries, which applies to England and Wales and came into force on 24th May 1915, contains the following (among other) provisions :—

American Gooseberry Mildew (Fruit) Order of 1915. *Prohibition of Sale or Consignment of Diseased Gooseberries.**—The sale or exposure for sale or consignment for sale of diseased gooseberries is hereby

* Disease in this and the following two Orders refer exclusively to American gooseberry mildew (*Sphaerotheca mors-uvae*).

prohibited, and any person who sells or exposes for sale or consigns for sale diseased gooseberries shall be liable on conviction to a penalty not exceeding ten pounds, unless he proves that he did not know that the gooseberries were diseased.

Regulation of Importation of Gooseberries.—(1) The landing in England or Wales of gooseberries brought from any place outside Great Britain (except the Channel Islands) is prohibited except where there is attached to the package in which the fruit is imported a label bearing the words "Imported gooseberries," and stating the country and district in which the fruit was produced, and either the name of the consignor, or a distinctive name or mark.

(2) The label required by this Article shall not be erased or obliterated or detached from the package so long as any of the imported gooseberries remain therein.

Labelling of Gooseberries Consigned for Sale.—(1) The consignment for sale of gooseberries is prohibited except where there is attached to the package a label bearing the name and address of the consignor or a distinctive name or mark.

(2) The label required by this Article shall not be erased or obliterated or detached from the package so long as any of the consigned gooseberries remain therein.

Information to be given as to Diseased Gooseberries.—Every person who has or has had in his possession diseased gooseberries, and every person who, as auctioneer, salesman or otherwise, has sold or offered for sale diseased gooseberries shall, if so required in writing by the Board or the Local Authority or an Inspector of the Board or Local Authority, give the Board or the Local Authority or the Inspector, as the case may be, all such information as he possesses as to the premises on which the gooseberries were grown, and as to the name and address of the person (if any) by whom the gooseberries were sold or consigned to him, or in the case of imported gooseberries as to the country and district in which the gooseberries were produced, and the consignor by whom and the consignee to whom the fruit was consigned to England or Wales; provided that any information given under this Article shall not be available as evidence against the person giving the same in any proceedings under this Order except in respect of an alleged failure to comply with this Article.

Destruction of Diseased Gooseberries.—An Inspector of the Board or of the Local Authority appointed for the purpose may by notice served on any person having in his possession or under his charge diseased gooseberries require him to destroy forthwith all such diseased gooseberries by fire or other effectual means, and for this purpose require him to remove the gooseberries from the package in which they are contained.

Cleansing of Packages containing Diseased Gooseberries.—A package which has contained diseased gooseberries shall, after the removal of all gooseberries therefrom, and before the package is used for packing gooseberries or any other description of fruit, be thoroughly cleansed by washing, or other suitable method, by the owner or person in charge of the package.

Powers of Inspectors to Enforce Cleansing of Packages.—An Inspector of the Board or of the Local Authority may by notice served on any person who has in his possession or under his charge a package which contains or has contained any imported gooseberries or any diseased

gooseberries, whether imported or not, require such person to cleanse the package thoroughly to his satisfaction by washing or other suitable method, or if such person so prefer, to destroy the same forthwith in the presence of the Inspector, and for the purpose of such cleansing or destruction to remove from the package any fruit therein.

Power to Prohibit Removal of Packages containing Diseased Gooseberries.—An Inspector of the Board or of the Local Authority may, by notice served on any person who has in his possession or under his charge a package which contains any diseased gooseberries, prohibit the removal of the package from the premises where it is, until the diseased gooseberries are removed therefrom.

Powers of Entry.—Any Inspector or other officer appointed in that behalf by the Local Authority, or by the Board, may upon production if so required of his appointment or authority enter any premises on which he has reason to believe that there are any imported or diseased gooseberries or is any package which contains or has contained any such gooseberries, and examine the gooseberries and packages on such premises.

Offences.—Every person shall be liable on conviction to a penalty not exceeding ten pounds, who—

- (1) consigns gooseberries for sale in contravention of this Order ; or
- (2) in contravention of this Order erases or obliterates or detaches a label from a package ; or
- (3) refuses or fails to give any information required under this Order, or gives false information ; or
- (4) fails to cleanse any package in accordance with this Order ; or
- (5) when served with a notice under this Order, fails to cleanse or destroy in the prescribed manner the package or fruit to which the notice relates, or to remove the fruit from the package ; or
- (6) removes any package in contravention of a notice served under this Order ; or
- (7) wilfully obstructs or impedes any Inspector or other officer in the course of his duties under this Order.

Revocation of Order.—(1) The American Gooseberry Mildew (Fruit) Order of 1914 is hereby revoked ; provided that such revocation shall not—

- (i.) affect the previous operation of that Order or anything duly done or suffered under that Order ; or
 - (ii.) affect any right, privilege, obligation, or liability acquired, accrued, or incurred under that Order ; or
 - (iii.) affect any penalty incurred in respect of any offence committed against that Order ; or
 - (iv.) affect any investigation, legal proceeding, or remedy in respect of any such right, privilege, obligation, liability, or penalty as aforesaid ;
- and any such investigation, legal proceeding, or remedy may be instituted, continued, or enforced, and any such penalty may be imposed, as if this Order had not been made.

(2) Every notice served under the Order hereby revoked shall have effect as if it were a notice under this Order.

Execution of the Order.—Each Local Authority shall carry into effect this Order within their District, and shall appoint such Inspectors or other officers for that purpose as may be necessary.

THE American Gooseberry Mildew (Infected Areas) Order of 1915 of the Board of Agriculture and Fisheries contains the following (among other) provisions :—

**American Gooseberry
Mildew (Infected
Areas) Order of 1915.**

1. *Application of Order.*—The provisions of this Order, which refer to an Infected Area, shall apply to any area which is declared by Order of the Board to be infected with "disease" as defined by this Order, and to be an Infected Area for the purposes of this Order.

2. *Notification of Disease.*—The occupier of any premises in an Infected Area on which disease exists or appears to exist shall forthwith notify the fact by post or otherwise to the Board, or to the person authorised by the Board to receive such reports. Where this Article applies Article 3 (*Notification of Disease*) of the American Gooseberry Mildew Order of 1911 shall not apply.

3. *Destruction of Diseased Fruit.*—The occupier of any premises in an Infected Area shall forthwith destroy on the premises by fire or other suitable method all diseased fruit of the gooseberry bushes on the premises.

4. *Removal of Visible Traces of Disease.*—All visible traces of disease on any part of a gooseberry bush within an Infected Area shall in each year be cut off and forthwith destroyed by fire by the occupier of the premises on which the bush is growing on or before the thirtieth day of September.

5. *Removal of Bushes.*—(1) No gooseberry bush or part of a gooseberry bush (other than fruit which is free from disease) shall be moved or permitted by the owner thereof to be moved out of an Infected Area except under the authority, and in accordance with the conditions (if any), of a licence granted by an Inspector of the Board.

(2) Where any bush has been moved in contravention of this Article an Inspector of the Board may, by notice served by post or otherwise on the person in whose possession or under whose charge the bush is, require the movement forthwith of the bush back to the premises from which it was lifted or taken for the purpose of the movement out of the Infected Area, or its destruction forthwith by fire if the owner so prefer.

6. *Partial Exemption from General Order.*—No part of an Infected Area shall be declared to be "infected premises" under the American Gooseberry Mildew Order of 1911, and any premises included in an Infected Area shall cease to be "infected premises."

8. *Offences.*—Every person shall be liable on conviction to a penalty not exceeding ten pounds, who—

- (1) fails to give notification of disease as required by Article 2 ; or
- (2) fails to destroy any diseased fruit as required by Article 3 ; or
- (3) fails to cut off and destroy all traces of disease as required by Article 4 ; or
- (4) moves or permits to be moved any bush in contravention of Article 5, or fails to comply with any notice served under that Article.

THE American Gooseberry Mildew (Kent) Order of 1915 of the Board of Agriculture and Fisheries, which will come into force on 1st July, 1915, contains the following (among other) provisions :—

**American Gooseberry
Mildew (Kent) Order
of 1915.**

Restriction on Movement of Bushes in Scheduled District.—(1) No gooseberry bush shall be moved, or be permitted by the occupier of the premises to be moved, from any premises in the District

described in the Schedule* to this Order (hereinafter referred to as "the Scheduled District"), to any other premises, whether within the Scheduled District or not, unless such movement is authorized by a licence signed by an Inspector of the Board; and where any premises in the same occupation are divided by a highway the several parts shall for the purposes of this Order be treated as separate premises.

(2) A licence may contain such conditions as the Inspector may think fit for the purpose of preventing the spread of disease.

Exceptions from Facilities for Movement.—No gooseberry bush shall be moved, or be permitted by the occupier of the premises to be moved, from any premises in the Scheduled District which is diseased or suspected of being diseased, or which has not been pruned in such manner as may have been required by an Inspector of the Board, whether the movement is authorized by a licence under this Order or not.

Production of Licences and Labels.—Any persons in charge of gooseberry bushes being moved in the Scheduled District, if so required by an Inspector of the Board or a police officer, shall produce and show to the Inspector or officer the licence or label (if any) accompanying the bushes in compliance with the conditions of a licence granted under this Order, and shall allow the Inspector or officer to make a copy of or extract from the licence or label, and shall give his name and address to the Inspector or officer.

Powers of Inspection of Bushes.—Any Inspector of the Board may upon production if so required of his appointment inspect any gooseberry bushes which are being moved in the Scheduled District, or have been moved from any premises in the Scheduled District.

Notification of Order.—This Order shall be published by the Local Authority of each District comprised in the Scheduled District by advertisement in a newspaper circulating in that District, or in such other manner as the Local Authority consider best fitted to insure publicity for the same.

Offences.—Every person shall be liable on conviction to a penalty not exceeding ten pounds, who—

(1) moves any bush, or permits any bush to be moved, in contravention of this Order; or

(2) fails to comply with the conditions inserted in a licence under this Order; or

(3) refuses, or without reasonable excuse fails, to produce or show or permit to be copied, a licence or label in accordance with the requirements of this Order, or fails to give his true name and address when required to give the same under this Order; or

(4) wilfully obstructs or impedes any Inspector or other officer in the course of his duties under this Order.

Revocation of Orders.—The American Gooseberry Mildew (Maidstone District) Order of 1910, the American Gooseberry Mildew (Sandwich District) Order of 1910, and the American Gooseberry Mildew (Swanley District) Order of 1910 are hereby revoked as from the commencement of this Order; provided that such revocation shall not—

(i.) affect the previous operation of those Orders or anything duly done or suffered under those Orders; or

(ii.) affect any right, privilege, obligation, or liability acquired, accrued, or incurred under those Orders; or

* The scheduled district for the purposes of the Order is the administrative county of Kent and the city of Canterbury.

- (iii.) affect any penalty incurred in respect of any offence committed against those Orders ; or
 (iv.) affect any investigation, legal proceeding, or remedy in respect of any such right, privilege, obligation, liability, or penalty as aforesaid ;
 and any such investigation, legal proceeding, or remedy may be instituted, continued, or enforced, and any such penalty may be imposed, as if this Order had not been made.

PART II. (Allotments and Miscellaneous) of the Annual Report of the proceedings of the Board during 1914 under the Small Holdings and Allotments Acts, the Universities and College Estates Acts, the Glebe Lands Act, the Improvement of Land Acts, the Settled Land Acts, the Agricultural Holdings Acts, and certain other Acts has been published [Cd. 7892], and may be obtained from Messrs. Wyman & Sons, or through any bookseller, price 8½d.

THE Annual Report for 1914 of the proceedings of the Board under the Tithe, Copyhold, Inclosure, Commons, Land Drainage and other Acts has been issued [Cd. 7916] and may be obtained from Messrs. Wyman & Sons, Ltd., or through any bookseller, price 2d.

MISCELLANEOUS NOTES.

IN compliance with a generally expressed desire on the part of farmers and representative agricultural bodies in Scotland, the Board of Agriculture for Scotland in the month of February, 1914, established a seed testing station at Edinburgh. Although the condition of the seed trade in Scotland might be considered in many respects satisfactory, it was thought that a seed testing station would be of great advantage, inasmuch as it would provide an authoritative method of testing seeds which would be accepted both by farmers and by seedsmen. Prior to the establishment of the station in Edinburgh seeds had to be tested either by private analysts in Scotland or (as was done to a large extent) at Continental stations. The analyses obtained from the Continent, although considered quite trustworthy, were reported in such a way as to be unsatisfactory for the grower's purpose, and the farmer could not make a comparison between the guarantee given to him by seedsmen whose seeds had been tested on the Continent and the result of a test made in this country. The farmers felt, therefore, that they were at a disadvantage, whilst the seedsmen admitted that the guarantees which they gave were not of much practical use to the farmers.

The special functions of the station may be defined as follows :—

- (1) To provide a cheap method of testing seeds available both to seedsmen and to farmers, and to test tree seeds for land-owners and nurserymen.

* Third Report of the Board of Agriculture for Scotland [Cd. 7899].
 Price 10½d.

- (2) To obtain information for the Board of Agriculture for Scotland and for the country as to the quantities of inferior seeds which are being sold.

The system of testing seeds adopted at the station, after very careful investigation of the various systems now in vogue, may be described briefly as follows :—

Purity Tests.—In testing for purity, only foreign seeds and foreign matter, such as sand, etc., are treated as impurities. Immature seeds and seeds without a kernel are retained as pure seeds.

Germination Tests.—All seeds of the species to which the sample purports to belong may be included without reference to their condition of maturity in the germination tests.

Tests made by these methods emphasise differences in grades of quality much more definitely than those made by Continental stations and private analysts, whose practice is generally to treat as impurities all immature seeds, and to include in the germination test only mature seeds. The methods practised at the Scottish Board's station should therefore be preferred by agriculturists who buy their seeds on a guarantee of quality. It may be added that the methods described above are identical with those used in the Seed Testing Station of the Department of Agriculture and Technical Instruction for Ireland.

The number of samples tested at the Station between the date of its opening and 31st December was 364. These fall into the following classes :—

(a)	Samples tested for Farmers and other Growers	..	74
(b)	„ „ Non-trading (Farmers') Societies	..	56
(c)	„ „ Educational Institutions, etc.	..	38
(d)	„ „ Co-operative Trading Societies	..	7
(e)	„ „ Merchants	150
(f)	„ „ Information of Station	..	39

The subjoined table indicates the groups of seeds tested and the nature of the tests :—

Description of Seeds.	For Purity only.	For Germination only.	For Complete Test.	Total.
Grasses*	6	21	163	190
Leguminous Plants	1	22	98	121
Forage Plants	—	3	12	15
Forest Tree Seeds	—	9	19	28
Cereals	—	1	4	5
Total	7	56	296	359

* Two samples of grasses and three others of a miscellaneous character were forwarded for identification only.

Samples of seeds received since the commencement of the present season have been, in general, of high quality. The following table indicates the average of the results of tests of the common species of grasses and clovers. These averages are not of selected samples but of all the samples submitted for analysis from October to December, 1914 :—

	Average Percentage of Purity.	Average Percentage of Germination.
Perennial Rye-grass ..	98.3	90
Italian Rye-grass ..	99.2	88.8
Cocksfoot	98.1	76.5
Meadow Fescue	98.3	94
Timothy	97.5	92
Alsike	97.2	91 + 6 hard seeds
Red Clover	98.4	92 + 5 "
White Clover	97.5	89 + 6 "
Trefoil	99.2	96 + 3 "

Fees.—The fee charged for reports on the purity and germination of samples is 2s. per sample when furnished to merchants and others engaged in the sale of seeds, and 3d. per sample when furnished to others (farmers, foresters, gardeners, etc.).

A German Karakul Sheep Breeding Centre.—The Karakul sheep breeding centre at Naunhof, near Leipzig, is described in the *Deut. Landw. Presse*, 21st April, 1915. It was

Notes on founded about ten years ago by the purchase
Agriculture Abroad. of pure bred ewes partly direct from Bokhara and partly from Hagenbeck's collection;

and the owner, who at the time possessed some dye works and handled large quantities of skins, was led to establish the centre from a consideration of the profit to be obtained from the successful breeding of these sheep. The animals became acclimatised in spite of stall feeding and relatively little pasturage, and there have been hardly any deaths from disease. The animals may only be pastured in dry weather, and are found to take cover during rain. The herd at present comprises 30 pure bred ewes. A herd book is kept and the animals are judged when lambs by the curl of the hair, this being of the first importance. The rams have been widely distributed, in particular to South West Africa.

Live Stock at the Panama-Pacific International Exhibition, 1915.—The Panama-Pacific International Exhibition, which is now being held at San Francisco, includes a section for live stock, and awards will be made for all classes of animals. The exhibition dates for the various classes are as follows:—Horses, September 30th to October 13th; beef and dairy cattle, October 18th to November 1st; sheep and goats, November 3rd to 15th; fat cattle, sheep and swine, November 11th to 14th; poultry, November 18th to 28th. A total sum of £91,780 is available for prizes and other expenditure connected with the live stock section, of which £20,900 has been contributed by 45 breed societies. Most of the well-known British breeds will be recognised by the authorities.

Applications for full particulars should be addressed to Chief D. O. Lively, Department of Live Stock, Panama-Pacific International Exposition, San Francisco, California.

Importation of Live Stock and Fodder into Bermuda.—Regulations have recently been made in the Colony of Bermuda whereby, under the Animal Diseases Act of 1914, horses, asses, mules, cattle, sheep, goats, and pigs (as well as fodder accompanying the animals), cannot

be landed without a written permit issued by the Government Veterinary Officer. All animals in the Colony are subject to inspection and to quarantine. The importation of bulls, dairy cows and pigs, from the United States of America is prohibited. It is indicated that these regulations will remain in force until the end of the year 1916.

Importation of Animals into Canada.—The Canadian Department of Agriculture has resumed the issue of permits for the importation into Canada of cattle, sheep and swine from any port of the United Kingdom.

THE *Bulletin of Agricultural and Commercial Statistics* for May, 1915, issued by the International Institute of Agriculture, gives the condition of winter cereals on 1st May as follows (100 being taken to represent the prospect of an average crop):—

Notes on Crop Prospects Abroad.—*Wheat*—Denmark 96, Scotland 100, Ireland 101, Switzerland 98, Canada 112, Japan 106, Lower Egypt 105, Upper Egypt 102, Tunis 130. *Rye*—Denmark 99, Ireland 101, Switzerland 98. *Barley*—Denmark 100, Scotland 105, Ireland 101, Switzerland 99, Japan 100, Lower Egypt 99, Upper Egypt 104, Tunis 125. *Oats*—Denmark 100, Scotland 105, Ireland 101, Switzerland 99, Tunis 110.

Australia.—The amended estimate of the wheat yield in 1914-15 places the production at 3,114,000 qr., against 12,915,000 qr. in 1913-14, the decrease amounting to 75·9 per cent.

France.—According to a statement giving the results of an enquiry into the agricultural situation on 1st May, as compared with that on 1st May, 1914, the area sown with wheat in the whole of France, including the invaded territories, is over 14,000,000 acres, or about 2,000,000 acres less than in 1914, with rye about 2,500,000 acres compared with nearly 3,000,000 acres, with barley about 1,700,000 acres against over 1,800,000 acres, and with oats nearly 8,500,000 acres as compared with about 10,000,000 acres in 1914. The condition of wheat was 72 as compared with 71 in 1914, of rye 70 against 74, of barley 74 against 71, and of oats 73 against 70 in 1914. (100 = very good, 80 = good, 60 = fairly good). (*The London Grain, Seed and Oil Reporter*, 28th May.)

Italy.—A preliminary official estimate puts the wheat crop at 25,700,000 qr., compared with 21,200,000 qr. last year. (*Broomhall's Corn Trade News*, 13th May.)

Russia.—According to a report of the Central Statistical Committee, the condition of both spring and winter crops on 1st April was, on the whole, quite favourable. Only in two out of thirty-two governments was the state of the winter crops, and in one out of seven that of the spring sowings not quite satisfactory. In all other governments from which data is available the condition is average or above average. (*The London Grain, Seed and Oil Reporter*, 25th May.)

United States.—The Crop Reporting Board of the Department of Agriculture, in reporting as to crop conditions on the 1st June, states that the production of winter wheat is estimated at 676,000,000 bush. as compared with a yield of 684,990,000 bush. last year. The area sown with spring wheat was 19,248,000 acres, and the yield is estimated at 274,000,000 bush. against 206,027,000 bush. last year. The area

under oats is 40,193,000 acres, and the total production is estimated at 1,288,000,000 bush. against 1,141,000,000 bush. last year; whilst the area under barley is 7,393,000 acres, and the total production is estimated at 197,000,000 bush. against 194,953,000 bush. last year. (*The London Grain, Seed and Oil Reporter*, 8th June.)

Argentina.—According to a return issued by the Argentine Ministry of Agriculture on the 8th June, the total production of wheat is estimated at 4,585,000 tons as compared with 3,100,000 tons last year; oats, 831,000 tons against 740,000 tons; and linseed, 1,126,000 tons against 995,000 tons last year. (*The London Grain, Seed and Oil Reporter*, 8th June.)

Fruit.—*Holland.*—His Britannic Majesty's Consul-General at Rotterdam reported (12th May) that the prospects for all sorts of small fruit were generally very favourable, although blossoming was somewhat late on account of the wet and cold weather during the first three months of the year. In the provinces of North Holland and North Brabant some injury had been done by night frosts, whilst in the Westland district, the Hoeksche Waard and in Zealand insects have done some damage. *Early Cherries.*—In Gelderland, north of the Rhine, in the west of Utrecht and about Herwynen and Yzendoorn conditions were good, in Limburg excellent, and in all other districts very good. *Late Cherries* were excellent in the Hoeksche Waard and in Limburg, good to very good in South Beveland, and very good in eastern North Brabant. *Red and White Currants* were good in the Westland district, in Gelderland north of the Rhine, in Overijssel and in the south-east of Utrecht, and very good elsewhere. *Black Currants* were good in the Lower Betuwe, the district of Maas and Waal, around Utrecht and in the south-east of that province and moderate to very good in other parts of the country, while the reports from Limburg were excellent. *Gooseberries* were moderate in Utrecht, good in the Lower Betuwe, good to very good in West Friesland and in the Beemster, very good in Zealand and excellent in Limburg. *Raspberries* were good to very good in all parts of the country.

Live Stock in Japan.—The numbers of live stock at the end of 1913 were as follows:—Cattle 1,388,708, against 1,399,498 at the end of 1912, or a decrease of 0·8 per cent.; horses 1,533,829, against 1,581,743, or a decrease of 3·0 per cent.; sheep 2,946, against 3,308, or a decrease of 10·9 per cent.; pigs 309,995, against 308,970, or an increase of 0·3 per cent. (*Bulletin of Agricultural and Commercial Statistics*, May, 1915.)

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st June, the supply of labour was reported to be deficient in all districts, and wages for the most part

Agricultural Labour rose. The conditions in various districts were
in England and Wales as follows:—
during May.

Northumberland, Durham, Cumberland, and Westmorland.—In many places there was a great scarcity of labour, and in Northumberland wages were increased by 2s. to 3s. per week, while 15 per cent. to 20 per cent. increase was reported from Cumberland and Westmorland. A great lack of servants was disclosed as a result of the Whitsuntide hirings.

Lancashire and Cheshire.—The supply of labour was deficient, and wages rose.

Yorkshire.—There was a general deficiency, particularly among horsemen, and increases in wages were frequently reported.

Shropshire and Stafford.—Labour was scarce throughout the district.
Derby, Nottingham, Leicester, and Rutland.—The supply was deficient in all districts and wages were tending still higher. May hirings in East Notts showed a considerable increase.

Lincoln and Norfolk.—Labour was short, but the deficiency appeared to be less felt in Norfolk where it was mostly "just sufficient." Wages at the May hirings showed a rise.

Suffolk, Cambridge, and Huntingdon.—There was a deficiency in the supply of labour generally.

Bedford, Northampton, and Warwick.—Labour was deficient and casual labour difficult to obtain, or inefficient. Rises of 1s. to 3s. per week in wages were reported from many districts.

Buckingham, Oxford, and Berkshire.—Labour was generally deficient, and more would be required for singling and for getting in the hay.

Worcester, Hereford, and Gloucester.—The supply of labour was very scarce.

Cornwall, Devon, and Somerset.—The supply of labour was generally deficient.

Dorset, Wiltshire, and Hampshire.—The supply of labour was very deficient.

Surrey, Kent, and Sussex.—Labour generally was deficient, and it was anticipated that with the heavier work the shortage would soon be seriously felt. In one or two districts of Kent there was some slight increase in wages. Farmers, however, were making the best of the new conditions.

Essex, Hertford, and Middlesex.—There was a shortage of labour practically everywhere, and during the month there was a rise in wages of 1s. per week in western Essex.

North Wales.—Labour was reported as deficient through the district, except in Anglesey, where, however, casual labourers were scarce, and in Carnarvon, where it is anticipated that there would be a shortage for the harvest. There was a rise of wages in these two counties and in Denbigh from 1s. to 3s. per week.

Mid-Wales.—In some districts labour was scarce, but, generally, the farmers were adapting themselves to the shortage. In Radnor, the wages of single men, living in, rose 10 per cent.

South Wales.—There was a great scarcity of labour in almost every district in this division. Higher wages were asked in south-eastern Glamorgan.

THE Crop Reporters of the Board, in commenting on agricultural conditions in England and Wales on the 1st June, state that wheat

**Agricultural
Conditions in England
and Wales on 1st June.**

is generally in a healthy and vigorous condition, and has improved during the month, though on some of the heavy lands it is rather discoloured. Barley and oats are somewhat backward, the cold nights and dry weather having retarded their growth. All crops would be benefited by warmer weather and more rain. The area under barley is estimated to be about 6 per cent. less than in 1914, but that of oats is about 5 per cent. larger. Beans and peas are generally promising.

† Early potatoes have been affected by the frosts in some districts, but are mostly healthy. The planting of the main crop is nearly completed, but very little is yet showing above ground. The area planted is estimated to be about the same as in last year.

Nearly all the mangolds have been got in, but germination is slow. Where it is up, the plant is looking healthy. Turnip sowing is generally backward, having been delayed by shortage of labour and the dry weather.

Hops in Kent, though backward, are generally strong and healthy, and the growth is now progressing. There is some fly but not much as yet. In the western hop counties the condition of the crop is good, but the growth has been checked by the cold winds and frosts of the past month. The area under the crop is estimated at 5 per cent. less than that of last year.

The prospects for the fruit crops are good at the date of the reports. Strawberries, raspberries, gooseberries and currants promise to be over average crops, while apples, pears and cherries are also expected to yield good crops. Plums are the least satisfactory, but may amount to an average.

Crops of both "seeds" hay and meadow hay are expected to be below the average for the country as a whole, with slightly better prospects for the former. Wales, however, anticipates an over average yield for both crops, but in England the yield is expected to be from 2 to 5 per cent. below the normal. The prospects of the crops have been affected by low temperature and lack of rain. The area reserved for hay from "seeds" is expected to be slightly less than in 1914, but that of meadow hay is estimated to be about the same.

The pastures generally need rain, but stock on the whole are doing well.

**Prevalence of
Animal Diseases
on the Continent.**

The following statement shows that according to the information in the possession of the Board on 1st June, 1915, certain diseases of animals existed in the countries specified :—

Denmark (month of April).

Anthrax, Foot-and-Mouth Disease (1,132 outbreaks), Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period 2nd—15th May).

Foot-and-Mouth Disease, Glanders and Farcy.

Holland (month of April).

Anthrax, Foot-and-Mouth Disease (64 outbreaks), Foot-rot, Glanders, Swine Erysipelas.

Italy (for the period 10th—16th May).

Anthrax, Blackleg, Foot-and-Mouth Disease (97 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of April).

Anthrax, Blackleg.

Rumania (for the period 5th—13th April).

Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Russia (month of December).

Anthrax, Foot-and-Mouth Disease (43,787 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of March).

Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of April).

Anthrax, Blackleg, Foot-and-Mouth Disease, (16 outbreaks), Swine Fever.

Switzerland (for the period 17th—23rd May).

Anthrax, Blackleg, Foot-and-Mouth Disease (7 “*étales*” entailing 91 animals, of which 6 “*étales*” were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, Bulgaria, Germany, Hungary, Montenegro, Serbia.

The Weather in England during May.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	No. of Days with Rain.	Daily Mean	Diff. from Average.	
<i>Week ending May 8th :</i>	*F.	*F.	In.	Mm.*	Mm.*	Hours.	Hours.	
England, N.E.	47·9	+1·1	0·18	4	— 6	2	6·7	+0·9
England, E.	51·8	+3·4	0·11	3	— 7	2	7·4	+1·2
Midland Counties ...	51·6	+3·3	0·22	5	— 6	2	5·9	+0·3
England, S.E....	54·1	+4·5	0·11	3	— 7	1	7·0	+0·7
England, N.W. ...	49·4	+1·4	0·23	6	— 7	2	6·9	+1·2
England, S.W. ...	53·5	+4·5	0·39	10	— 4	2	5·9	—0·4
English Channel ...	53·8	+3·1	0·44	11	— 0	4	4·1	—3·5
<i>Week ending May 15th :</i>								
England, N.E....	44·5	—3·2	0·75	19	+ 8	3	6·7	+0·4
England, E.	47·0	—2·5	1·42	36	+26	4	7·3	+0·8
Midland Counties ...	46·7	—2·7	1·10	28	+18	4	6·6	+0·6
England, S.E....	49·7	—1·1	1·71	44	+35	3	7·1	+0·4
England, N.W. ...	45·3	—3·8	0·56	14	+ 2	2	6·7	+0·4
England, S.W. ...	48·9	—1·3	1·42	36	+24	3	6·5	—0·2
English Channel ...	51·0	—0·8	0·75	19	+10	3	6·1	—2·1
<i>Week ending May 22nd :</i>								
England, N.E.	50·0	+1·1	0·13	3	— 7	2	4·9	—1·6
England, E.	51·8	+0·9	0·37	10	— 1	3	3·8	—2·8
Midland Counties ...	52·1	+1·3	0·71	18	+ 6	3	5·0	—1·1
England, S.E....	53·2	+0·9	1·45	37	+27	4	3·9	—2·9
England, N.W. ...	52·0	+1·5	0·46	12	— 1	3	6·4	—0·2
England S.W. ...	53·0	+1·3	0·80	20	+ 8	4	3·3	—3·6
English Channel ...	54·0	+1·0	0·30	8	— 2	3	4·6	—3·5
<i>Week ending May 29th :</i>								
England, N.E.	50·9	+0·2	0·31	8	— 2	2	8·9	+2·5
England, E.	53·8	+1·1	0·02	1	—10	1	10·2	+3·3
Midland Counties ...	54·2	+1·6	0·04	1	—12	1	10·5	+4·5
England, S.E....	56·3	+2·3	0·00	0	—11	0	11·4	+4·5
England, N.W. ...	53·9	+1·8	0·10	2	—11	1	11·9	+5·2
England, S.W. ...	57·3	+4·2	0·05	1	—12	0	12·1	+5·3
English Channel ...	57·3	+3·0	0·01	0	—12	0	12·0	+4·0

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked
or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	59	77	326	392
Animals attacked	66	81	363	418
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	11
Animals attacked	—	—	—	74
Glanders (including Farcy):—				
Outbreaks	2	9	13	42
Animals attacked	2	10	18	89
Parasitic Mange:—				
Outbreaks	137	161	*326	1,257
Animals attacked	295	257	*734	2,247
Sheep-Scab:—				
Outbreaks	11	5	154	144
Swine Fever:—				
Outbreaks	566	605	1,841	1,770
Swine Slaughtered as diseased or exposed to infection ...	2,793	6,559	8,339	17,926

* Figures for two months only, the Parasitic Mange Order of 1911 having been suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and
Technical Instruction for Ireland.)

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	—	1	1	1
Animals attacked	—	1	1	1
Foot-and-Mouth Disease:—				
Outbreaks	—	8	—	74
Animals attacked	—	119	—	946
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	3	—
Parasitic Mange:—				
Outbreaks	7	6	23	45
Sheep-Scab:—				
Outbreaks	27	24	240	335
Swine Fever:—				
Outbreaks	26	16	121	104
Swine Slaughtered as diseased or exposed to infection ...	172	122	739	517

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in May and April, 1915.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	MAY.		APRIL.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	12 10	11 9	11 3	10 6
Herefords	12 2	10 11	11 3	10 2
Shorthorns	12 3	11 4	11 2	10 4
Devons	12 3	11 5	11 4	10 6
Welsh Runts	—	—	10 11	10 2
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	11	10	10½	9½
Sheep :—				
Downs	11½	10½	11½	10½
Longwools	11	10	10½	9½
Cheviots	12½	11½	12½	11½
Blackfaced	12	11	12	11½
Welsh	12	10½	12	11
Cross-breds	11½	10½	12	10½
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs :—				
Bacon Pigs	9 4	8 9	9 5	8 11
Porkers	9 9	9 2	9 10	9 3
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	25 6	20 17	24 5	20 1
„ —Calvers ...	23 0	19 17	23 3	19 4
Other Breeds—In Milk ...	21 10	18 15	22 3	18 4
„ —Calvers ...	17 15	16 17	19 9	16 12
Calves for Rearing	3 0	2 8	2 16	2 3
Store Cattle :—				
Shorthorns—Yearlings ...	13 10	11 13	13 2	11 2
„ —Two-year-olds...	18 4	16 3	17 7	15 4
„ —Three-year-olds...	22 7	19 9	22 0	18 15
Herefords —Two-year-olds...	21 3	19 1	19 15	18 1
Devons— „	20 0	17 4	18 14	17 2
Welsh Runts— „	17 1	16 10	17 3	16 5
Store Sheep :—				
Hoggs, Hoggets, Togs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	56 8	50 0	58 2	50 9
Store Pigs :—				
8 to 12 weeks old	24 10	19 3	24 1	18 6
12 to 16 weeks old	41 2	30 10	39 8	30 6

* Estimated carcass weight.

AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in May, 1915.

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	83 6	83 6	—	89 0	85 0
	2nd	78 6	81 0	—	85 0	81 0
Cow and Bull	1st	74 6	77 6	77 0	76 6	78 0
	2nd	70 0	71 6	72 6	71 6	73 6
Irish : Port Killed	1st	—	—	85 0	86 0	82 6
	2nd	—	—	81 6	82 0	78 0
Argentine Frozen— Hind Quarters	1st	67 0	65 6	65 6	67 0	65 6
Fore „	1st	62 6	63 0	62 0	60 6	62 0
Argentine Chilled— Hind Quarters	1st	78 6	78 6	79 6	79 0	79 6
Fore „	1st	66 6	64 6	66 6	65 6	66 6
Australian Frozen— Hind Quarters	1st	65 0	65 6	64 6	64 6	64 6
Fore „	1st	63 0	62 6	62 0	62 0	62 0
VEAL :—						
British	1st	85 6	85 6	87 0	91 0	84 6
	2nd	80 6	81 6	78 6	81 6	78 0
Foreign... ..	1st	—	—	—	94 6	—
MUTTON :—						
Scotch	1st	—	—	106 0	101 6	105 6
	2nd	—	—	101 0	97 0	101 0
English... ..	1st	92 6	100 6	—	94 6	100 6
	2nd	84 6	95 0	—	89 0	94 6
Irish : Port Killed	1st	—	—	102 6	—	98 0
	2nd	—	—	93 6	—	91 0
Argentine Frozen	1st	58 0	59 6	59 6	57 0	56 6
Australian „	1st	54 6	54 6	53 0	54 0	53 0
New Zealand „	1st	60 6	60 0	—	61 0	—
LAMB :—						
British	1st	109 6	119 0	112 0	110 0	115 6
	2nd	106 6	109 6	104 0	101 6	105 0
New Zealand	1st	78 0	77 0	77 6	75 6	77 6
Australian	1st	71 0	70 0	70 0	70 6	70 0
Argentine	1st	70 6	70 0	68 0	70 6	68 0
PORK :—						
British	1st	83 6	77 0	78 0	83 0	75 0
	2nd	79 6	74 6	71 6	78 0	70 6
Foreign... ..	1st	—	—	—	—	—

**AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS in ENGLAND in May, 1915.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.
British... ..	16 6	15 6	—	—	15 3	14 3
Irish Creamery—Fresh	per cwt. 144 6	per cwt. 141 6	per cwt. 144 0	per cwt. 141 6	per cwt. 142 6	per cwt. 139 6
„ Factory	133 6	129 6	135 6	130 6	135 6	130 6
Danish... ..	—	—	154 6	152 6	153 0	150 0
French... ..	—	—	—	—	138 6	134 6
Russian	—	—	—	—	134 0	130 0
Australian	142 0	139 0	141 0	138 0	139 0	135 6
New Zealand	145 6	142 6	145 6	143 6	145 0	141 6
Argentine	140 6	138 0	138 0	136 0	137 0	134 0
CHEESE :—						
British—						
Cheddar	105 6	100 6	103 6	102 6	105 0	100 0
Cheshire	—	—	120 lb. 96 0	120 lb. 91 0	120 lb. 101 6	120 lb. 96 0
Canadian	98 0	97 0	per cwt. —	per cwt. —	per cwt. 98 0	per cwt. 94 6
BACON :—						
Irish (Green)	96 6	93 0	94 0	91 0	93 0	90 0
Canadian (Green sides)	84 6	80 6	85 6	81 6	85 0	80 6
HAMS :—						
York (Dried or Smoked)	118 0	115 0	—	—	117 0	111 6
Irish (Dried or Smoked)	—	—	—	—	111 0	107 0
American (Green) (long cut)	71 0	68 0	71 0	68 0	74 0	70 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British... ..	11 10	11 0	—	—	12 8	11 8
Irish	11 11	11 8	11 9	11 3	12 7	12 0
Danish... ..	—	—	—	—	13 6	12 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	110 0	92 6	91 6	85 0	102 6	93 0
Langworthy	100 0	90 0	105 0	100 0	111 0	101 0
Up-to-Date	102 6	87 6	86 6	80 0	105 0	95 0
HAY :—						
Clover	—	—	126 0	102 6	110 6	102 0
Meadow	—	—	—	—	104 6	96 0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1913, 1914 and 1915.

Weeks ended (in 1915).	WHEAT.						BARLEY.						OATS.					
	1913.		1914.		1915.		1913.		1914.		1915.		1913.		1914.		1915.	
Jan. 2 ...	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
" 9 ...	30	5	31	1	44	4	28	6	26	2	29	10	19	10	18	2	26	6
" 16 ...	30	3	30	11	46	2	28	4	25	11	29	7	19	2	18	4	26	5
" 23 ...	30	5	31	0	48	9	28	6	26	0	30	5	19	4	18	6	27	6
" 30 ...	30	11	30	11	51	6	28	10	26	3	31	3	19	4	18	11	28	10
Feb. 6 ...	31	1	31	1	52	8	28	11	26	6	32	5	20	2	19	1	29	10
" 13 ...	31	0	31	0	53	3	28	10	26	7	33	7	20	1	18	9	30	3
" 20 ...	30	9	31	0	54	8	29	1	26	7	34	7	20	2	18	11	31	5
" 27 ...	30	11	31	0	56	0	28	8	26	7	34	11	20	7	18	11	31	5
Mar. 6 ...	31	0	31	0	56	0	28	6	26	6	35	3	20	4	18	11	31	8
" 13 ...	31	3	31	5	55	11	28	5	26	2	34	6	20	0	18	9	31	8
" 20 ...	31	1	31	6	54	8	27	11	26	0	33	5	20	2	18	7	31	0
" 27 ...	31	1	31	5	53	9	27	6	25	8	32	2	19	11	18	6	30	7
Apl. 3 ...	31	3	31	4	54	3	27	0	25	7	31	11	19	7	18	8	30	6
" 10 ...	31	4	31	6	54	6	27	0	25	6	31	9	19	2	18	5	30	6
" 17 ...	31	6	31	7	55	4	26	11	25	4	30	10	18	10	18	4	30	5
" 24 ...	31	8	31	9	56	5	26	7	25	6	31	5	19	3	18	5	30	11
May 1 ...	32	2	31	9	58	3	25	11	26	0	32	7	19	6	18	5	31	5
" 8 ...	32	6	32	2	60	5	25	9	25	6	33	3	19	6	18	9	32	4
" 15 ...	32	10	32	7	61	7	25	4	26	3	34	0	19	9	18	11	32	5
" 22 ...	32	10	33	0	62	1	25	3	25	10	34	1	19	11	19	0	32	8
" 29 ...	32	7	33	9	61	11	26	1	26	1	34	8	20	1	19	4	32	7
June 5 ...	32	10	34	0	61	9	26	2	25	11	35	4	19	8	19	4	32	5
" 12 ...	32	8	34	1			24	7	24	11			20	2	19	8		
" 19 ...	32	8	34	1			23	10	25	10			19	8	19	9		
" 26 ...	32	8	34	3			24	3	25	4			19	1	20	0		
July 3 ...	33	1	34	4			25	2	24	6			21	0	19	9		
" 10 ...	33	4	34	2			25	10	24	9			19	4	20	0		
" 17 ...	33	6	34	1			24	9	24	2			20	5	19	10		
" 24 ...	33	10	34	0			24	1	24	7			20	8	19	9		
" 31 ...	34	1	34	2			24	5	25	9			20	3	19	8		
Aug. 7 ...	34	1	34	9			24	9	25	2			19	0	19	1		
" 14 ...	34	3	40	3			24	7	29	4			18	7	25	1		
" 21 ...	33	7	38	9			26	5	29	10			18	8	24	3		
" 28 ...	32	7	36	2			29	0	30	3			17	10	23	5		
Sept. 4 ...	31	11	36	5			30	11	30	6			17	8	23	9		
" 11 ...	31	9	37	10			31	5	29	11			18	0	23	11		
" 18 ...	31	7	38	3			30	9	29	5			17	11	23	8		
" 25 ...	31	6	37	6			30	1	29	3			17	9	23	3		
Oct. 2 ...	31	3	37	1			29	9	29	1			17	10	22	9		
" 9 ...	31	0	36	8			29	1	28	10			17	10	22	5		
" 16 ...	30	11	36	7			28	8	28	8			17	9	22	4		
" 23 ...	30	7	37	2			28	7	28	7			18	0	22	5		
" 30 ...	30	1	37	10			28	2	28	3			17	9	23	7		
Nov. 6 ...	30	0	38	8			28	1	28	6			17	9	23	7		
" 13 ...	30	1	39	8			27	8	29	0			17	11	24	8		
" 20 ...	30	4	41	0			27	5	29	8			18	1	25	5		
" 27 ...	30	9	41	11			27	0	30	3			18	4	25	8		
Dec. 4 ...	31	2	42	2			26	8	30	2			18	4	25	9		
" 11 ...	31	2	42	1			26	5	29	11			18	6	25	9		
" 18 ...	31	2	42	7			25	11	29	8			18	5	25	9		
" 25 ...	31	0	43	3			25	10	29	9			18	4	25	11		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

**AVERAGE PRICES of British Wheat, Barley, and Oats at
certain Markets during the Month of May, 1914 and 1915.**

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
London	33 8	59 10	24 9	34 0	20 6	33 3
Norwich	32 2	60 2	24 8	33 1	18 3	32 1
Peterborough ...	32 6	60 6	25 11	33 6	19 1	32 5
Lincoln	32 11	61 2	25 6	32 9	19 3	32 4
Doncaster	32 5	60 4	24 2	32 9	18 9	31 5
Salisbury	32 1	59 9	23 9	34 8	18 9	33 4

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Sutton, M. H. F.—The Effects of Radio-Active Ores and Residues on Plant Life. (15 pp.) Reading: Sutton & Sons [1915]. 2s. 6d. net. [63·168.]

Herefordshire Education Committee.—Results of a Demonstration on Poor High-lying Arable Land, which had not yielded a paying Crop for Years. (2 pp.) Shirehall, Hereford, 1915. [63·16(04).]

Horwood, A. R.—The Story of Plant Life in the British Isles. Vol. III. (514 pp.). London: J. & A. Churchill, 1915. 6s. 6d. net. [58·19.]

Dixon, H. H.—Transpiration and the Ascent of Sap in Plants. (216 pp.) London: Macmillan & Co., 1914. 5s. net. [58·11.]

Coulter, J. M.—The Evolution of Sex in Plants. (140 pp.) Chicago: University Press. [London: Cambridge University Press], 1914. 4s. net. [58·11.]

Board of Education.—School Attendance and Employment in Agriculture. Summary of Returns supplied by Local Education Authorities for the Period 1st September, 1914—31st January, 1915 [Cd. 7881]. (25 pp.) London: Wyman & Sons, 1915. 3d. [33·1.]

North of Scotland College of Agriculture.—Bull. 19:—The Composition and Value of Liquid Manure. (29 pp.) Aberdeen, 1915. [63·163.]

Green, J. L.—Village Industries: A National Obligation. (180 pp.) London: Rural World Publishing Co. [1915]. 1s. 6d. [63(42).]

Kenny, J.—Intensive Farming in India. (585 pp.) London: Luzac & Co., 1912. 6s. [63(024): 63(54).]

Johnson, C. P.—The Useful Plants of Great Britain: a Treatise upon the principal native Vegetables capable of Application as Food, Medicine or in the Arts and Manufactures. [Illustrated by J. E. Sowerby.] (324 pp. + XXV. pl.) London: R. Hardwicke, n.d. 25s. (second-hand.) [58·19.]

Ohio Agricultural Experiment Station.—Bull. 279:—The Maintenance of Fertility: Liming the Land. (22 pp.) Wooster, Ohio, 1914. [63·15.]

Rhode Island Agricultural Experiment Station.—Bull. 160:—The Comparative Effect on Different kinds of Plants of Liming an Acid Soil. (407-446 pp.) Kingston, R.I., 1914. [63·15.]

U.S. Department of Agriculture.—Bull. 169:—Injury by Disinfectants to Seeds and Roots in Sandy Soils. (35 pp.) [58·11.] Bull. 186:—A Method of Fumigating Seed. (6 pp.) [63·1951: 63·294.] Washington, 1915.

Royal Commission on Sewage Disposal.—Ninth Report, Vol. I:—Report. I. Disposal of Liquid Wastes from Manufacturing Processes. II. Disposal of Liquid and Solid Domestic Refuse in Rural Areas. [Cd. 7819.] (190 pp.) 1s. 9d. Vol. II:—Evidence and Appendices [Cd. 7820.] (160 pp.) 1s. 4d. Final Report:—General Summary of Conclusions and Recommendations. [Cd. 7821.] (19 pp.) 3d. London: Wyman & Sons, 1915.

Field Crops—

Herefordshire Education Committee.—Farmers' Bull. 9:—Report on the Manuring of Mangels—Season, 1914. (9 pp.) Shirehall, Hereford, 1915. [63:332.]

Herefordshire County Council Agricultural Sub-Committee.—Leaflet 14:—Report on Potato Experiments at New Ground Farm, Wigginton—Season, 1914. (7 pp.) St. Albans, 1915. [63:512(64).]

Rome, International Institute of Agriculture.—The World's Supply of Wheat and other Cereals, with Supplement, by Sir James Wilson. (43 + 18 pp.) Rome, 1915. [63:31:31.]

Rome, International Institute of Agriculture.—Statistical Notes on the Production, Imports and Exports, Prices and Maritime Freight of Cereals. (47 pp.) Rome, 1915. 25 centimes. [3459, A. 51.] [63:31:31.]

Taylor, E. R.—The Cultivation of Sugar Beet and Manufacture of Beet Sugar in the British Isles. (31 pp.) Liverpool: Incorporated English Beet Sugar Pioneer Association, 1915. [63:3432; 664:1.]

U.S. Department of Agriculture.—Farmers' Bull. 646:—Crimson Clover: Seed Production. (13 pp.) Washington, 1915. [63:33(6).]

Horticulture—

Thomas, H. H. [edit.].—Gardening for Amateurs: A Simple, Complete and Practical Guide for Garden Lovers. 4 vols. (1136 pp.) London: Waverley Book Company [1915.] 41 8s. 6d. the 4 vols. [63:52.]

Brett, W.—War-Time Gardening: How to grow your own Food. (64 pp.) London: "The Smallholder" [1915.] 6d. net. [63:5(62).]

Plant Diseases—

Stebbing, E. P.—Indian Forest Insects of Economic Importance—*Coleoptera*. (648 pp. + LXIII. pl.) London: Eyre & Spottiswoode, 1914. 15s. [63:27-49.]

Ontario Department of Agriculture.—Bull. 229:—Smuts and Rusts of Grain Crops. (24 pp.) Toronto, 1915. [63:24.]

Wisconsin Agricultural Experiment Station.—Circ. 52:—Control of Potato Diseases in Wisconsin. (19 pp.) Madison, Wis. 1914. [63:24-33; 63:27-33.]

Delaware Agricultural Experiment Station.—Bull. 105:—The Composition of Lime-Sulfur Solutions. (30 pp.) Newark, Delaware, 1914. [63:295.]

Live Stock—

Townshend, G. A.—Practical Rabbit Keeping. (299 pp.) London: Cassell & Co., 1912. [63:60.]

Gay, C. W.—The Principles and Practice of Judging Live Stock. (413 pp.) New York and London: The Macmillan Co., 1914. 6s. 6d. net. [63:6(664).]

Porter, J.—The Stockfeeder's Companion. (XX. + 316 pp.) London: Gurney and Jackson, 1915. 3s. 6d. net. [63:604.]

R. S. Timmis.—Modern Horse Management. (233 pp.) London: Cassell & Co. [1915.] 12s. 6d. net. [619:1; 63:61(62).]

Ohio Agricultural Experiment Station.—Bull. 270:—Experiments in Winter Lamb Production. (199-223 pp.) Wooster, Ohio, 1914. [63:63.]

Wyoming Agricultural Experiment Station.—Bull. 103:—I. Corn v. Barley in Lamb Rations. II. Methods of Feeding Barley to Lambs. (7 pp.) Laramie, Wyoming, n.d. [63:63.]

Dairying and Food, General—

U.S. Department of Agriculture.—Bull. 148:—The Use of *Bacillus Bulgaricus* in Starters for making Swiss or Emmentaler Cheese. (16 pp.) Washington, 1915. [63:736.]

Wisconsin Agricultural Experiment Station.—Research Bull. 33:—(a) Comparative Efficiency for Growth of the Nitrogen of Alfalfa Hay and Corn Grain; (b) The Comparative Efficiency for Milk-Production of the Nitrogen of Alfalfa Hay and Corn Grain. (87-119 pp.) Madison, Wisc., 1914. [63:604(a); 63:711(a).]

Birds, Poultry, and Bees—

- Powell-Owen, W.*—The Intensive System of Poultry Keeping. (42 pp.) London: Poultry Press, 6d. net. [63.651(04).]
West of Scotland Agricultural College.—Bull. 64:—Poultry Keeping. (109-171 pp.) Glasgow, 1914. [63.65(02).]
New South Wales, Department of Agriculture.—Farmers' Bull. 93:—Sixth Annual Conference of Poultry Farmers, Hawkesbury Agricultural College, June, 1914. (16 pp.) Sydney, 1914. [63.65(944).]
U.S. Department of Agriculture.—Farmers' Bull. 624:—Natural and Artificial Brooding of Chickens. (14 pp.) Washington, 1914. [63.6: 69; 63.651(04).]
Robinson, J. H.—Principles and Practice of Poultry Culture. (611 pp.) Boston: Ginn & Co., 1912. [63.65(02).]
Harper Adams Agricultural College.—Bull. 1 of 1915:—Report of the Second Twelve Months Poultry Laying Competition carried out in conjunction with the Utility Poultry Club. (84 pp.) Newport, Salop, 1915. 2d. post free. [63.651(04).]
U.S. Department of Agriculture, Bureau of Animal Industry.—Bull. 110, Part III. :—A Biometrical Study of Egg Production in the Domestic Fowl. III. :—Variation and Correlation in the Physical Characters of the Egg. (171-241 pp.) Washington, 1914. [63.651(04); 63.74.]
U.S. Department of Agriculture.—Farmers' Bull. 630:—Some Common Birds Useful to the Farmer. (27 pp.) Washington, 1915. [59.162.]
U.S. Department of Agriculture.—Bull. 171:—Food of the Robins and Bluebirds of the United States. (31 pp.) [59.162.] Bull. 187:—Preliminary Census of Birds of the United States. (11 pp.) [59.82.] Washington, 1915.
Watson, J. [edit.].—Farm Vermin: Helpful and Hurtful. (85 pp.) London: W. Rider & Son, n.d. 2s. 6d. [63.269.]

Forestry—

- Moore, F. F. and Brown, N. C.*—Elements of Forestry. (392 pp.) New York: J. Wiley & Sons; London: Chapman & Hall, 1914. 8s. 6d. net. [63.49(022).]
Maxwell, Sir H.—Trees: A Woodland Notebook. (235 pp.) Glasgow: J. Maclehose & Sons, 1915. 21s. net. [63.49: 58.]
Burt, E. A. P.—The Railway Rates Standard Timber Measurer. (323 pp.) [3rd Edition.] London: W. Rider & Son, n.d. 4s. net. [63.49-198.]
Chapman, H. H.—Forest Valuation. (310 pp.) New York: J. Wiley & Sons; London: Chapman & Hall, 1915. 8s. 6d. net. [63.49: 31; 63.49(021).]
Bunyard, G.—Handbook of Hardy Trees and Shrubs. [The Planters' Handbook.] (160 pp.) Maidstone: G. Bunyard & Co., 1908. 3s. 6d. net. [63.498.]

Engineering—

- Savage, W. G.*—Rural Housing. (297 pp.) London: T. Fisher Unwin, 1915. 7s. 6d. net. [333.32; 69(02).]
Ohio Agricultural Experiment Station.—Circ. 147:—The Cost of Tile Drainage: A Study of the Cost of Installing Thirty-five Miles of Tile Drains in Huron County, Ohio. (21-44 pp.) Wooster, Ohio, 1914. [63.14.]
Widsoe, J. A.—The Principles of Irrigation Practice. (496 pp.) New York and London: The Macmillan Co., 1914. 7s. 6d. net. [63.13.]
Washington Agricultural Experiment Station.—Bull. 117:—Report on Fires occurring in Threshing Separators in Eastern Washington during the Summer of 1914. (22 pp.) Pullman, Washington, 1914. [63.17.]
Martin, E. A.—Dew Ponds: History, Observation and Experiment. (208 pp.) London: T. Werner Laurie. [1915.] 6s. net. [628.7.]

Economics—

- Brooks, T. J.*—Markets and Rural Economics: Science of Commerce and Distribution. (397 pp.) New York: The Shakespeare Press, 1914. [338.1.]
Ham, A. H., and Robinson, L. G.—A Credit Union Primer. (79 pp.) New York: Russell Sage Foundation, 1914. 25 cents. [332.71(04).]
Carver, T. N.—Principles of Rural Economics. (386 pp.) Boston [U.S.A.]: Ginn & Co., 1911. 5s. net. [338.1.]
Inter-denominational Conference of Social Service Unions.—Land and Labour: being a Series of Lectures given at Swanwick, Derbyshire, June 20th-29th, 1914. (167 pp.) London [1915], 2s. 6d. [331; 338.1.]

